1964

COMET
and
FALCON

SHOP MANUAL

1964

COMET-FALCON

SHOP MANUAL

SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY

SECOND PRINTING—OCTOBER, 1963

GROUP INDEX

SPECIFICATIONS AT END OF EACH GROUP

FOREWORD

This shop manual provides the Service Technician with complete information for the proper servicing of the 1964 Comet and Falcon cars.

The information is grouped according to the type of work being performed, such as diagnosis and testing, frequently performed adjustments and repairs, in-vehicle adjustments, overhaul, etc. Specifications and recommended special tools are included.

Refer to the opposite page for important vehicle identification data.

The descriptions and specifications in this manual were in effect at the time this manual was approved for printing. The Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

SERVICE DEPARTMENT

FORD MOTOR COMPANY

COMET IDENTIFICATION

FIG. 1—1964 Comet Warranty Plate

Figure 1 illustrates the 1964 Comet warranty plate. The plate is located on the rear face of the left front door panel.

The official Vehicle Identification Number for title and registration purposes is stamped on the left fender apron (Fig. 2). Do not use the "Vehicle Warranty Number" which appears on the warranty plate for title or registration purposes.

FIG. 2—1964 Comet Vehicle Identification Number Location

VEHICLE DATA

Example (Fig. 1)

(54B DM 17 26H 34 1 3)

54B	4-Door Sedan
DM	Silver Turquoise and Polar White
17	Turquoise Random Fabric Light Turquoise Metallic Crush Vinyl
26H	26th Day August
34	Detroit District
1	3.00:1 Ratio
3	2-Speed Automatic

ASSEMBLY PLANT CODES

Code	Assembly Plant
H	Lorain
J	Los Angeles
T	Metuchen
S	Pilot Plant

MODEL AND BODY STYLE CODES

Serial Code	Body Code	Body Type	Model
02	54A	4-Door Sedan (Bench)	Comet 202
01	62A	2-Door Sedan (Bench)	
12	54B	4-Door Sedan (Bench)	Comet 404
11	62B	2-Door Sedan (Bench)	
11	62C	2-Door Sedan (Bucket)	
32	71A	4-Door Wagon (Bench)	Comet 202 Station Wagon
34	71B	4-Door Wagon (Bench)	Comet 404 Station Wagon
36	71C	4-Door Woodrail Wagon (Bench)	
22	54C	4-Door Sedan (Bucket)	Comet Caliente
22	54D	4-Door Sedan (Bench)	
23	63C	2-Door Hardtop (Bucket)	
23	63D	2-Door Hardtop (Bench)	
23	63E	2-Door Hardtop (Bucket)	
25	76B	2-Door Convertible (Bucket)	
25	76D	2-Door Convertible (Bench)	

COLOR CODES

A single-letter code designates a solid body color and two letters denote a two-tone—the first letter, the lower color and the second letter, the upper color.

Code	M-30-J/ M-32-J/*	Color	Sales Name
A	1724	Black	Onyx
B	1638	Peacock	Peacock
D	1625	Medium Turquoise Metallic	Silver Turquoise
F	1622	Medium Blue Metallic	Pacific Blue
G	1636	Buff	Palomino
J	1515	Red	Carnival Red
K	1621	Silver Blue Metallic	Anniversary Silver
M	1619	White	Polar White
R	1633	Yellow	Yellow Mist
T	1631	Light Beige	Fawn
X	1632	Maroon Metallic	Burgundy
Y	1623	Light Blue	Glacier Blue
Z	1630	Medium Beige Metallic	Platinum Beige

*"M-32-J" Acrylic Paint Alternate with "M-30-J".

TRIM CODES

A two-digit number indicates the type of trim and trim color.

If, due to unavailability or other difficulties in production, a particular trim set is not intended for service (minor deviation from intended trim), the warranty plate code will be followed with a numerical designation—For example: 52-1, 52-2.

If the trim set is serviced directly, the warranty plate code will bear an alphabetical suffix—For example: 52-A, 52-B.

Code	Trim Schemes	
	Random Fabric and	**Crush Vinyl**
12	Blue	Light Blue Metallic
14	Beige	Light Beige Metallic
16	Black	Black
17	Turquoise	Light Turquoise Metallic
	Bright Check Fabric and	**Crush Vinyl**
21	Silver Blue	Light Silver Blue Metallic
22	Blue	Light Blue Metallic
24	Beige	Light Beige Metallic
26	Black	Black
27	Turquoise	Light Turquoise Metallic
		Crush Vinyl (•) Crinkle
32		Light Blue Metallic
35		Red
36		Black
37		Light Turquoise Metallic
39		Medium Palomino (•)
	Block Stripe Fabric and	**Crush Vinyl**
42	Blue	Light Blue Metallic
44	Beige	Light Beige Metallic
46	Black	Black
		Crush Vinyl (•) Crinkle
62		Light Blue Metallic
65		Red
66		Black
67		Light Turquoise Metallic
69		Medium Palomino (•)
		Crush Vinyl (•) Crinkle
72		Medium and Light Blue Metallic
75		Red
76		Black
79		Medium Palomino (•)
		Crinkle Vinyl
89		Medium Palomino

DATE CODES

A number signifying the date precedes the month code letter. A second-year code letter will be used if the model exceeds 12 months.

Month	Code First Year	Code Second Year
January	A	N
February	B	P
March	C	Q
April	D	R
May	E	S
June	F	T
July	G	U
August	H	V
September	J	W
October	K	X
November	L	Y
December	M	Z

DSO AND DISTRICT CODES

Units built on a Domestic Special Order, Foreign Special Order, or other special orders will have the complete order number in this space. Also to appear in this space is the two-digit code number of the District which ordered the unit. If the unit is a regular production unit, only the District code number will appear.

Code	District	Code	District
11	Boston	34	Detroit
16	Philadelphia	41	Chicago
15	New York	42	St. Louis
14	Washington	45	Twin Cities
21	Atlanta	51	Denver
22	Dallas	52	Los Angeles
23	Jacksonville	53	Oakland
26	Memphis	54	Seattle
31	Buffalo	81	Ford of Canada
32	Cincinnati	84	Home Office Reserve
33	Cleveland	90-99	Export

REAR AXLE RATIO CODES

A number designates a conventional axle, while a letter designates an Equa-Lock differential.

Code	Ratio
1	3.00:1
3	3.20:1
4	3.25:1
5	3.50:1
6	2.80:1

TRANSMISSION CODES

Code	Type
1	3-Speed Manual
3	2-Speed Automatic
4	Dual Range 3-Speed Automatic
5	4-Speed Manual

VEHICLE WARRANTY NUMBER

Example (Fig. 1): 4H 12F 500001

4	1964 Model Year
H	Lorain Assembly Plant
12	4-Door Sedan
F	8-Cylinder, 260 Cubic Inch Disp.
500001	First Unit Built (Consecutive Unit No.)

MODEL YEAR CODE

The numeral "4" designates 1964.

ENGINE IDENTIFICATION CODES

Code	Engine
U	6-Cylinder 170 Cubic Inch
T	6-Cylinder 200 Cubic Inch
F	8-Cylinder 260 Cubic Inch
K	8-Cylinder 289 Cubic Inch
*4	6-Cylinder 170 Cubic Inch
*6	8-Cylinder 260 Cubic Inch

*Low Compression.

CONSECUTIVE UNIT NUMBER

Each model year, each assembly plant begins production with the number 500001 and continues on for each car built.

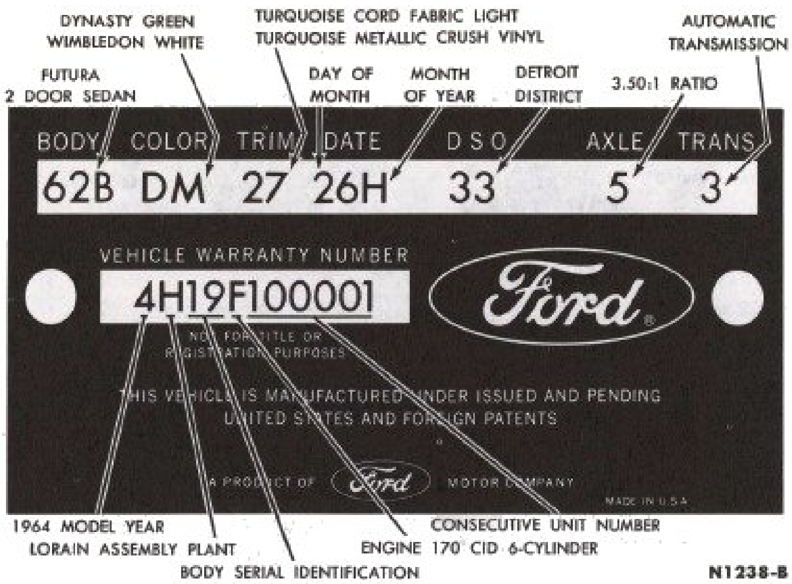


FIG. 3—1964 Falcon Warranty Plate

Figure 1 illustrates the 1964 Falcon Warranty Plate. The plate is located on the rear face of the left front door panel.

The official Vehicle Identification Number for title and registration purposes is stamped on the left cowl-to-front-spring pocket strut (Fig. 4). Do not use the "Vehicle Warranty Number" which appears on the Warranty plate for title or registration purposes.

FIG. 4—1964 Falcon Vehicle Identification Number Location

VEHICLE DATA

Example (Fig. 3):

(62B DM 27 26H 33 5 3)

62B	Futura 2-Door Sedan
DM	Dynasty Green and Wimbledon White
27	Turquoise Cord Fabric Light Turquoise Met. Crush Vinyl
26H	26th Day August
33	Detroit District
5	3.50:1 Ratio
3	2-Speed Automatic

ASSEMBLY PLANT CODES

Code	Assembly Plant
A	Atlanta
H	Lorain
K	Kansas City
R	San Jose
S	Pilot Plant
T	Metuchen

MODEL AND BODY STYLE CODES

Serial Code	Body Code	Body Type	Model
02	54A	4-Door Sedan	
02	54D	4-Door Sedan (RPO)	Standard
01	62A	2-Door Sedan	Sedan
01	62D	2-Door Sedan (RPO)	
16	54B	4-Door Sedan ((Bench)	
19	62B	2-Door Sedan (Bench)	
17	63B	2-Door Hardtop (Bench)	
11	63C	2-Door Hardtop (RPO Bucket)	Futura
13	63D	2-Door Hardtop Sprint (RPO Bucket)	
15	76A	Convertible (Bench)	
12	76B	Convertible (RPO Bucket)	
14	76D	Convertible Sprint (RPO Bucket)	
21	59A	2-Door Wagon	
22	71A	4-Door Wagon	Station
24	71B	4-Door Wagon Deluxe	Wagons
26	71C	4-Door Squire	
27	66A	2-Door Standard Ranchero	Ranchero
27	66B	2-Door Deluxe Ranchero	
29	78A	Standard Sedan Delivery	Sedan
29	78B	Deluxe Sedan Delivery	Delivery

COLOR CODES

A single letter code designates a solid body color and two letters denote a two-tone—the first letter, the lower color and the second letter, the upper color.

Code	M-30-J/ M-32-J#	Color	Sales Name
A	1724	Black	Raven Black
D	1625	Medium Turquoise Metallic	Dynasty Green
F	1622	Medium Blue Metallic	Guardsman Blue
G	1636	Buff	Prairie Tan
J	1515	Red	Rangoon Red
K	1621	Silver Mink Metallic	Silvermore Gray
M	1619	White	Wimbledon White
X	1632	Maroon Metallic	Vintage Burgundy
Y	1623	Light Blue	Skylight Blue
Z	1630	Medium Beige Metallic	Chantilly Beige

#"M-32-J" Acrylic Paint Alternate with "M-30-J".

TRIM CODES

Code	Trim Schemes	
	Band Fabric and	**Crush Vinyl**
12	Blue	Light Blue Metallic
14	Beige	Light Beige Metallic
15	Red	Red
	Cord Fabric and	**Crush Vinyl**
22	Blue	Light Blue Metallic
24	Beige	Light Beige Metallic
25	Red	Red
27	Turquoise	Light Turquoise Metallic
	Steerhead Vinyl	
44	Medium Beige	Light Beige Metallic
		Crush Vinyl (Bench) (•) Crinkle
62		Medium & Light Blue Metallic
64		Beige & Light Beige Metallic
65		Red
66		Black
67		Medium & Light Turquoise Metallic
69		Medium Palomino (•)
		Crush Vinyl (Bucket) (•) Crinkle
82		Medium & Light Blue Metallic
85		Red
86		Black
87		Medium & Light Turquoise Metallic
89		Medium Palomino (•)

DATE CODES

A number signifying the date precedes the month code letter. A second-year code letter will be used if the model exceeds 12 months.

Month	Code First Year	Code Second Year
January	A	N
February	B	P
March	C	Q
April	D	R
May	E	S
June	F	T
July	G	U
August	H	V
September	J	W
October	K	X
November	L	Y
December	M	Z

DSO AND DISTRICT CODES

Units built on a Domestic Special Order, Foreign Special Order, or other special orders will have the complete order number in this space. Also to appear in this space is the two-digit code number of the District which ordered the unit. If the unit is a regular production unit, only the District code number will appear.

Code	District	Code	District
11	Boston	26	Washington
12	Buffalo	31	Cincinnati
13	New York	32	Cleveland
14	Pittsburgh	33	Detroit
15	Newark	34	Indianapolis
21	Atlanta	35	Lansing
22	Charlotte	36	Louisville
23	Philadelphia	41	Chicago
24	Jacksonville	42	Fargo
25	Richmond	43	Rockford

DSO AND DISTRICT CODES (Continued)

Code	District	Code	District
44	Twin Cities	65	Oklahoma City
45	Davenport	71	Los Angeles
51	Denver	72	San Jose
52	Des Moines	73	Salt Lake City
53	Kansas City	74	Seattle
54	Omaha	81	Ford of Canada
55	St. Louis	83	Government
61	Dallas	84	Home Office Reserve
62	Houston	85	American Red Cross
63	Memphis	89	Transportation Services
64	New Orleans	90-99	Export

REAR AXLE RATIO CODES

A number designates a conventional axle, while a letter designates an Equa-Lock differential.

Code	Ratio	Code	Ratio
2	3.10:1	B	3.10:1
3	3.20:1	C	3.20:1
4	3.25:1	D	3.25:1
5	3.50:1	E	3.50:1
9	4.00:1	I	4.00:1

TRANSMISSION CODES

Code	Type
1	3-Speed Manual
3	2-Speed Automatic
4	Dual Range
5	4-Speed Manual

VEHICLE WARRANTY NUMBER

Example (Fig. 3): 4H19F 100001

4	1964 Model Year
H	Lorain Assembly Plant
19	2-Door Sedan (Bench)
F	8-Cylinder, 260 Cubic Inch Disp.
100001	First Unit Built (Consecutive Unit Number)

MODEL YEAR CODES

The numeral "4" designates 1964

ENGINE IDENTIFICATION CODES

Code	Engine
S	6-Cylinder 144 Cubic Inch
U	6-Cylinder 170 Cubic Inch
*F	8-Cylinder 260 Cubic Inch
*4	6-Cylinder 170 Cubic Inch
*6	8-Cylinder 260 Cubic Inch

*Low Compression.

CONSECUTIVE UNIT NUMBER

Each assembly plant begins production with the number 100001 and continues on for each car built.

BRAKES

GROUP 2

PART 2-1 GENERAL BRAKE SERVICE

1 DIAGNOSIS AND TESTING

PRELIMINARY TESTS

1. Check the fluid in the master cylinder, and add FoMoCo **heavy-duty** brake fluid as required.

2. Push the brake pedal down as far as it will go while the car is standing. If the car is equipped with power brakes, the engine should be running while making this test. If the brake pedal travels more than halfway between the released position and the floor, check the automatic adjusters for being inoperative. To check adjuster operation, inspect the brake shoes and the adjuster mechanisms for binding or improper installation and follow the procedure described under "Brake Shoe Adjustments" in Part 2-2, Section 2.

Make several reverse stops to ensure uniform adjustment at all wheels. This procedure applies to power brakes only.

3. With the transmission in neutral, stop the engine and apply the parking brake. Depress the service brake pedal several times to exhaust all vacuum in the system. Then, depress the pedal and hold it in the applied position. Start the engine. If the vacuum system is operating, the pedal will tend to fall away under foot pressure and less pressure will be required to hold the pedal in the applied position. If no action is felt, the vacuum booster system is not functioning. Follow the procedures in the "Booster Diagnosis Guide".

4. With the engine shut off, exhaust all vacuum in the system (power brakes only). Depress the brake pedal and hold it in the applied position. If the pedal gradually falls away under this pressure, the hydraulic system is leaking. Check all tubing hoses, and connections for leaks.

If the brake pedal movement feels spongy, bleed the hydraulic system to remove air from the lines and cylinder. See "Hydraulic System Bleeding", Section 2. Also, check for leaks or insufficient fluid.

5. Should one of the brakes be locked and the car must be moved, open the brake cylinder bleeder screw long enough to let out a few drops of brake fluid. **This bleeding operation will release the brakes, but it will not correct the cause of the trouble.**

ROAD TEST

The car should be road tested only if the brakes will safely stop the car. Apply the brakes at a speed of 25-30 mph to check for the existence of the trouble symptoms listed in Table 1, with the exception of those resolved in the preliminary tests and brake chatter. For each of the symptoms encountered, check and eliminate the causes which are also listed in Table 1. To check for brake chatter or surge, apply the brakes lightly from approximately 50 mph.

BOOSTER DIAGNOSIS GUIDE

For booster removal and installation procedures, refer to Part 2-2, Section 3. For disassembly and assembly procedures, refer to Part 2-2, Section 4. For cleaning and inspection refer to Part 2-1, Section 3.

TROUBLE SYMPTOMS, CAUSES, AND CORRECTIONS

BOOSTER INOPERATIVE—HARD PEDAL	If the preliminary tests show that the booster is inoperative or if a hard pedal condition still exists after eliminating the causes of "Hard Pedal" listed in Table 1, the trouble may be caused by vacuum leakage. Disconnect the vacuum line at the booster, remove the vacuum manifold and check valve assembly, and look for a sticking or faulty check valve. Check all vacuum connections for leakage or obstruction. Check all hoses for a leaking or collapsed condition. Repair or replace parts as necessary. If the foregoing procedure does

CONTINUED ON NEXT PAGE

TROUBLE SYMPTOMS, CAUSES, AND CORRECTIONS (Continued)

BOOSTER INOPERATIVE—HARD PEDAL (Continued)	not eliminate the trouble, remove the booster from the car. Separate the front shell from the rear shell, and check the valve and rod assembly reaction disc, diaphragm plate, and diaphragm assembly for damage that would cause leaks. When assembling, be sure that the diaphragm assembly is properly positioned. Improper location could cause leakage between the vacuum and atmospheric sides of the diaphragm.
BRAKES DRAG OR GRAB	If the brakes still drag or grab after eliminating the causes listed in Table 1, the condition is probably caused by a sticking valve plunger assembly. Remove and disassemble the booster. Clean, inspect, and replace parts as necessary.
SELF APPLICATION OF BRAKES WHEN ENGINE STARTS	Remove and disassemble the booster. Check for a leak in the rear shell. Check the diaphragm for being out of locating radii in the housing. Check for a sticking or unseated valve poppet. Clean, inspect, and replace parts as necessary. Be sure that the diaphragm is properly located when assembling.

TABLE 1—Brake Trouble Symptoms aud Possible Causes

Possible Causes of Trouble Symptoms	Trouble Symptoms												
	One Brake Drags	All Brakes Drag	Hard Pedal	Spongy Pedal	Car Pulls to One Side	One Wheel Locks	Brakes Chatter	Excessive Pedal Travel	Pedal Gradually Goes to Floor	Brakes Uneven	Shoe Click Release	Noisy or Grabbing Brakes	Brakes Do Not Apply
Mechanical Resistance at Pedal or Shoes Damaged Linkage		X	X										
Brake Line Restricted	X	X	X		X								
Leaks or Insufficient Fluid				X				X	X				X
Improper Tire Pressure					X					X			
Improperly Adjusted or Worn Wheel Bearing	X				X								
Distorted or Improperly Adjusted Brake Shoe	X	X	X		X	X		X				X	
Faulty Retracting Spring	X				X								
Drum Out of Round	X				X		X						
Linings Glazed or Worn			X		X	X	X	X				X	X
Oil or Grease on Lining			X		X	X	X			X		X	X
Loose Carrier Plate	X					X	X						
Loose Lining					X		X						
Scored Drum										X		X	
Dirt on Drum-Lining Surface												X	
Faulty Wheel Cylinder	X				X	X						X	
Dirty Brake Fluid	X	X								X			X
Faulty Master Cylinder		X						X	X				X
Air in Hydraulic System	X			X				X					X
Self Adjusters Not Operating					X			X			X		
Insufficient Shoe-to-Breaking Plate Lubrication	X										X		
Tire Tread Worn						X							
Poor Lining to Drum Contact							X						
Loose Front Suspension							X						
"Threads" Left by Drum Turning Tool Pull Shoes Sideways											X		
Cracked Drum								X					
Sticking Booster Control Valve		X										X	

2 COMMON ADJUSTMENTS AND REPAIRS

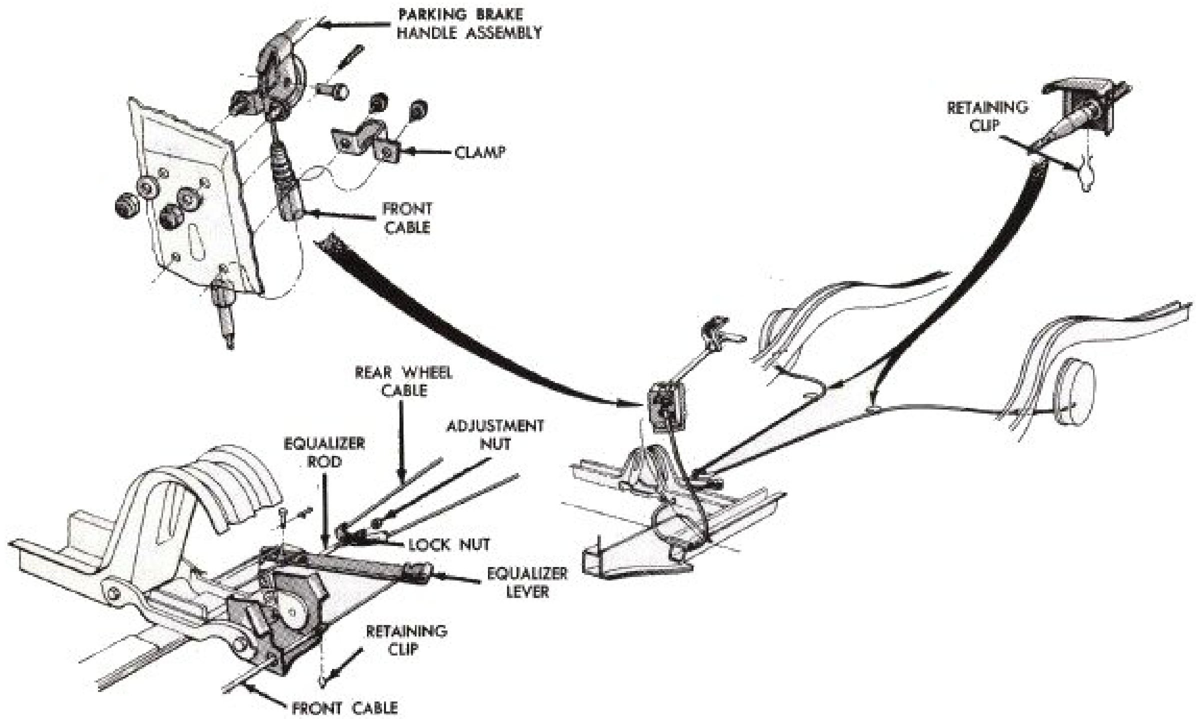


FIG. 1—Parking Brake Linkage

PARKING BRAKE LINKAGE ADJUSTMENT

Check the parking brake cables when the brakes are fully released. If the cables are loose, adjust them as follows.

1. Fully release the parking brake by turning the handle counterclockwise and pushing it inward.
2. Pull the parking brake handle outward one notch from its normal released position.
3. Raise the car.
4. Turn the lock nut in front of the equalizer (Fig. 1) several turns forward.
5. Turn the adjustment nut forward against the equalizer until a moderate drag is felt when turning the rear wheels.
6. When the cables are properly adjusted, tighten the lock nut in the direction of forward rotation against the equalizer.
7. Release the parking brake, and make sure that the brake shoes return to the fully released position and no drag is felt when turning the rear wheels.

MASTER CYLINDER PUSH ROD ADJUSTMENT—POWER BRAKES

The push rod is provided with an adjustment screw to maintain the correct relationship between the booster control valve plunger and the master cylinder piston. Failure to maintain this relationship will prevent the master cylinder piston from completely releasing hydraulic pressure and can cause the brakes to drag, or cause excessive brake pedal travel.

To check the adjustment of the screw, fabricate a gauge of the dimensions shown in Fig. 2. Then place the gauge against the master cylinder mounting surface of the booster body as shown in Fig. 3. The push rod screw should be adjusted so that the end of the screw just touches the inner edge of the slot in the gauge. Do not set up side forces on the push rod. Side forces may break the valve plunger.

This is an approximate adjustment only. The master cylinder piston should not move more than 0.015 inch as it contacts the push rod. No movement (exact contact) is ideal.

HYDRAULIC SYSTEM BLEEDING

When any part of the hydraulic

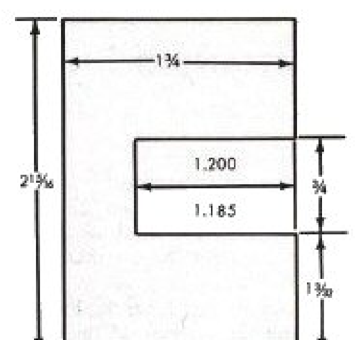


FIG. 2—Push Rod Gauge Dimensions

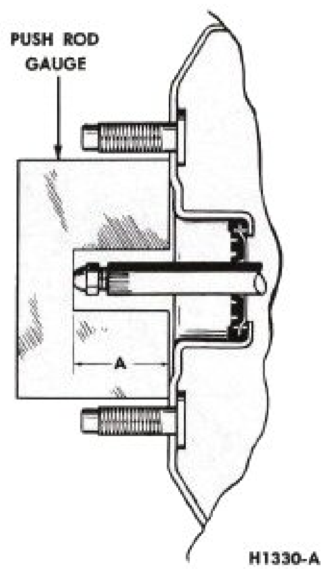


FIG. 3—Push Rod Adjustment

system has been disconnected for repair or replacement air may enter the system and cause spongy pedal action. Bleed the hydraulic system after it has been properly connected to be sure that all air is expelled.

The hydraulic system can be bled manually or with pressure bleeding equipment.

MANUAL BLEEDING

Bleed the longest lines first. Keep the master cylinder reservoir filled with new heavy-duty brake fluid during the bleeding operation.

Never use brake fluid which has been drained from the hydraulic system.

1. Position a suitable ⅜-inch box wrench (Fig. 4) on the bleeder fitting on the right rear brake wheel cylinder. Attach a rubber drain tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**

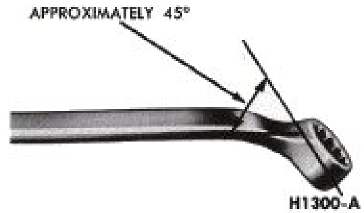


FIG. 4—Wrench for Bleeding Brake

2. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting approximately ¾ turn.
3. Push the brake pedal down slowly thru its full travel. Close the bleeder fitting, then return the pedal to the fully-released position. Repeat this operation until air bubbles cease to appear at the submerged end of the bleeder tube.
4. When the fluid is completely free of air bubbles, close the bleeder fitting and remove the bleeder tube.
5. Repeat this procedure at each brake wheel cylinder in the following order: left rear, right front, and left front. Refill the master cylinder reservoir after each wheel cylinder is bled and when the bleeding operation is completed. The fluid level should be within ⅜ inch from the top of the reservoir.

PRESSURE BLEEDING

Bleed the longest lines first. **Never use brake fluid which has been drained from the hydraulic system.**

The bleeder tank should contain enough new heavy-duty brake fluid to complete the bleeding operation, and it should be charged with 10-30 pounds of air pressure.

1. Clean all dirt from the master cylinder reservoir cap.
2. Remove the master cylinder reservoir cap, install an adapter cap to the reservoir, and attach the bleeder tank hose to the fitting on the adapter cap. An adapter cap can be fabricated by cutting a hole in the center of a filler cap and soldering a right angle fitting in the hole. A right angle fitting must be used on power brakes to provide clearance at the body brace.
3. Position a ⅜-inch box wrench (Fig. 4) on the bleeder fitting on the right rear brake wheel cylinder. Attach a bleeder tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**
4. Open the valve on the bleeder tank to admit pressurized brake fluid to the master cylinder reservoir.
5. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting.
6. When air bubbles cease to appear in the fluid at the submerged end of the bleeder tube, close the bleeder fitting and remove the tube.
7. Repeat this procedure at each brake wheel cylinder in the following order: left rear, right front, and left front.
8. When the bleeding operation is completed, close the bleeder tank valve and remove the tank hose from the adapter fitting.
9. Remove the adapter cap, refill the master cylinder reservoir to within ⅜ inch from the top of the reservoir, and install the filler cap.

3 CLEANING AND INSPECTION

BRAKE ASSEMBLY

1. Remove the wheel from the drum, then remove the drum as outlined in Part 2-2, Section 2. Wash all the parts except the brake shoes in a cleaning fluid and dry them with compressed air.
2. Brush all dust from the backing plates and the interior of the brake drums.
3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn to within 1/32 inch of any rivet head or if the shoes are damaged, they must be replaced. Replace any lining that has been oil saturated. Replace lining in axle sets. Prior to replacement of lining, the drum diameter should be checked to determine if oversize linings must be installed.
4. Check the condition of the brake shoes, retracting springs, and drum for signs of overheating. If the springs show any loss of load or change in free length, indicating overheating, replacement of the retracting and hold down springs is necessary. **Overheated springs lose their pull and could cause the new lining to wear prematurely, if they are not replaced.**
5. If the car has 24,000 or more miles of operation on the brake linings or signs of overheating are present when relining brakes, the wheel cylinders should be disassembled and inspected for wear and entrance of dirt into the cylinder. The cylinder cups should be replaced, thus avoiding future problems.

6. Inspect all other brake parts and replace any that are worn or damaged.

7. Inspect the brake drums and, if necessary, refinish them. Refer to Part 2-2, Section 4 for refinishing.

BOOSTER UNIT

A disassembled view of the brake booster is shown in Fig. 5.

After disassembly, immerse all metal parts in a suitable solvent. Use only alcohol on rubber parts or parts containing rubber. After the parts have been thoroughly cleaned and rinsed in cleaning solvent, the metal parts which come in contact with hydraulic brake fluid or rubber parts should be rewashed in clean alcohol before assembly. Use an air hose to blow dirt and cleaning fluid from the recesses and internal passages. When overhauling a power booster, use all parts furnished in the repair kit. **Discard all old rubber parts.**

Inspect all other parts for damage or excessive wear. Replace damaged or excessively worn parts. If the inside of the booster shells are rusted or corroded, polish them with steel wool or fine emery cloth.

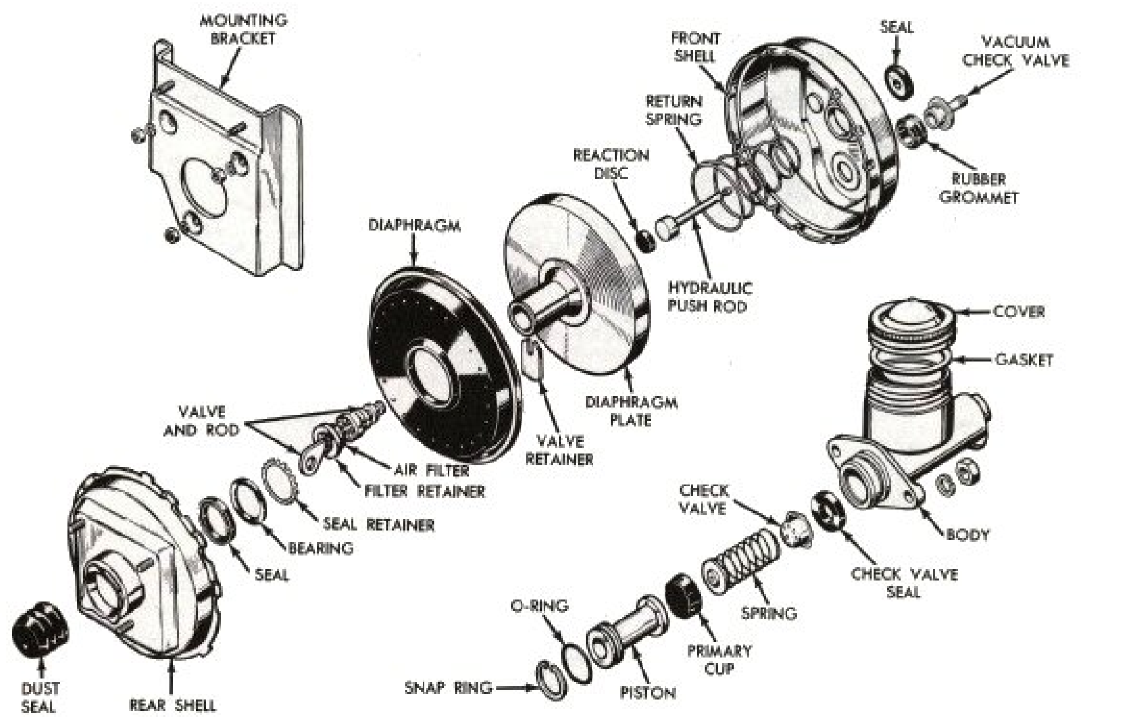


FIG. 5—Brake Booster and Master Cylinder Disassembled

PART 2-2 BRAKE SYSTEM

1 DESCRIPTION AND OPERATION

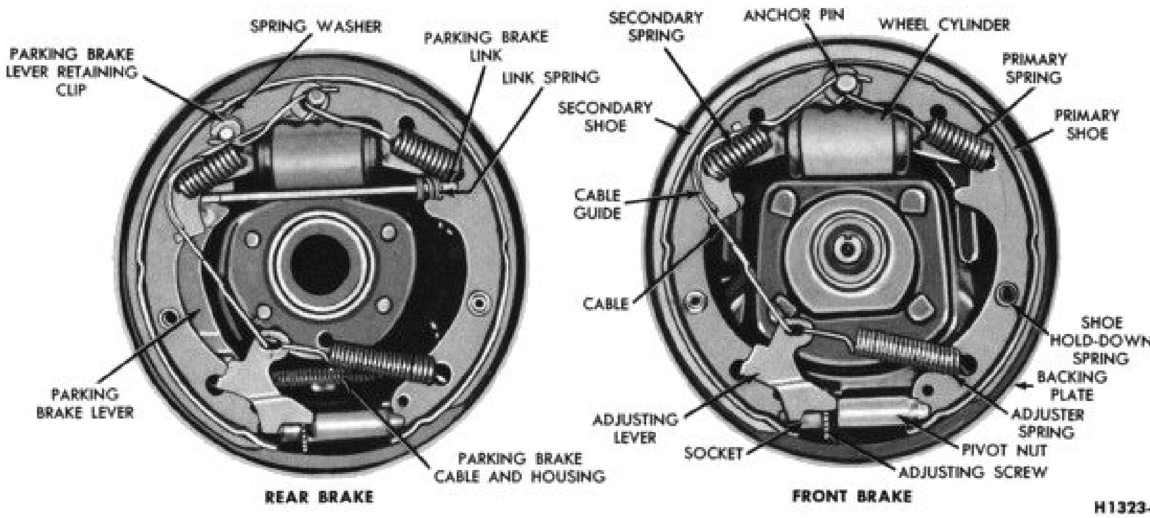


FIG. 1—Self Adjusting Brake Assemblies

HYDRAULIC SELF ADJUSTING BRAKE SYSTEM

The hydraulic brake system employs single anchor, internal expanding and self-adjusting brake assemblies. A vacuum booster is available as optional equipment on all cars equipped with an automatic transmission.

The master cylinder converts physical force from the brake pedal and booster into hydraulic pressure against the pistons in the wheel cylinders. The wheel cylinder pistons in turn convert hydraulic pressure back into physical force at the brake shoes.

The self-adjusting brake mechanism consists of a cable, cable guide, adjusting lever, and adjuster spring (Fig. 1). The cable is hooked over the anchor pin at the top and is connected to the lever at the bottom. The cable is connected to the secondary brake shoe by means of the cable guide. The adjuster spring is hooked to the primary brake shoe and to the lever. The automatic adjuster operates only when the brakes are applied while the car is moving rearward and only when the secondary shoe is free to move toward the drum beyond a predetermined point.

With the car moving rearward and the brakes applied, the "wrap-around" action of the shoes following the drum forces the upper end of the primary shoe against the anchor pin. The action of the wheel cylinder moves the upper end of the secondary shoe away from the anchor pin. The movement of the secondary shoe causes the cable to pull the adjusting lever upward and against the end of a tooth on the adjusting screw star-wheel. The upward travel of the lever increases as lining wear increases. When the lever can move upward far enough, it passes over the end of the tooth and engages the tooth. When the brakes are released, the adjusting spring pulls the level downward causing the star-wheel to turn and expand the shoes. The star-wheel is turned one tooth at a time as the linings progressively wear.

With the car moving forward and the brakes applied, the secondary shoe is against the anchor pin and the primary shoe is moved toward the drum. Therefore, the adjuster does not operate.

The rear brake assembly is basically the same as the front brake. The conventional parking brake lever, link, and spring are used in the rear brake.

The anchor pins on all brakes are fixed and are non-adjustable.

BOOSTER SYSTEM

The diaphragm type booster is a self-contained vacuum hydraulic power braking unit mounted on the engine side of the dash panel. It is of the vacuum suspended type which utilizes engine intake manifold vacuum and atmospheric pressure for its power. It consists of three basic elements combined into a single unit (Fig. 2).

The three basic elements are:

1. A vacuum power chamber which consists of a front and a rear shell, a power diaphragm, a hydraulic push-rod and a vacuum diaphragm return spring.

2. A mechanically actuated control valve integral with the vacuum power diaphragm controls the degree of

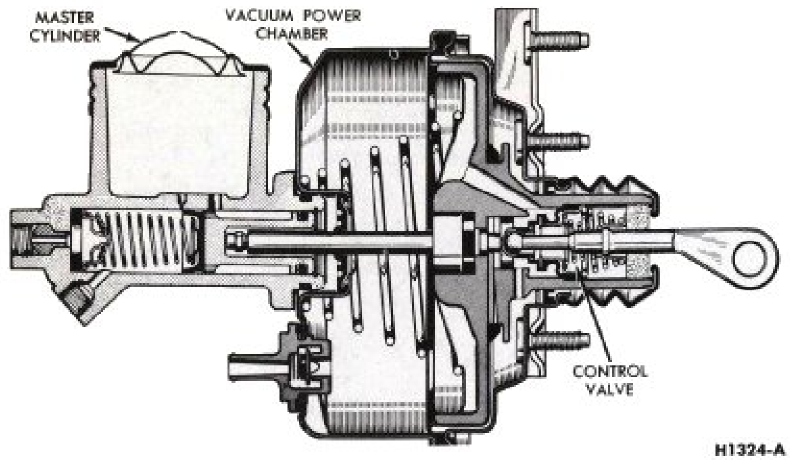


FIG. 2—Cutaway View of Vacuum Booster

power brake application or release in accordance with the foot pressure applied to the valve operating rod through the brake pedal linkage. The control valve consists of a single poppet with an atmospheric port and a vacuum port. The vacuum port seat is a part of the valve hub and diaphragm plate assembly. The atmospheric port seat is a part of the valve plunger which moves within the vacuum power diaphragm assembly.

3. A hydraulic master cylinder which contains all of the elements of the conventional brake master cylinder except for the hydraulic pushrod which has a self locking adjustment screw at one end with a piston head at the other end.

The vacuum power diaphragm and the components which make up the valve assembly are connected to the brake pedal through the valve operating rod and pedal linkage. The valve operating rod is connected to the valve plunger which moves within the power diaphragm assembly. A valve return spring holds the valve plunger and rod in the released position when pressure is released from the brake pedal. The valve poppet is of the flexible rubber type and is supported by the valve body. In the released position, the poppet return spring holds the poppet against the atmospheric port seat. A synthetic rubber seal is used to seal the opening between valve body sleeve and the rear shell. Vacuum is supplied to the booster through a vacuum check valve located in the front shell. Air for operation is admitted through the air cleaner located at the end of the valve sleeve. A rubber guard attached to a flange on the rear shell and over the air cleaner protects the valve housing and seal sleeve against dirt. A seal located in the front vacuum chamber seals the opening between the vacuum chamber and the hydraulic plunger. The hydraulic push rod forms the link between the vacuum power diaphragm assembly and the hydraulic piston of the master cylinder.

RELEASED POSITION

With the engine running and the brakes released (Fig. 3), vacuum from the intake manifold is admitted through the check valve to the front (constant vacuum) chamber of the power unit. In the released position (no pressure applied to the brake pedal), the valve operating rod and valve plunger are held to the right in the valve housing by the valve return spring to CLOSE the atmospheric port and OPEN the vacuum port. With the valve in this position, the rear (control vacuum) chamber is also open to vacuum through the porting in the vacuum diaphragm and valve housing assembly. The vacuum power diaphragm is then "balanced" or suspended in vacuum, since vacuum is present on both sides of the power diaphragm. With the power diaphragm balanced in vacuum, the diaphragm return spring holds the diaphragm and hydraulic push rod in the fully released position. With the hydraulic push rod in this position, the hydraulic compensating port in the hydraulic master cylinder is OPEN to permit brake fluid to either return from the brake system to the fluid reservoir or enter the brake system from the fluid reservoir to compensate for any gain or loss in fluid volume.

APPLIED POSITION

When the brakes are applied (Fig. 4), the valve operating rod and valve

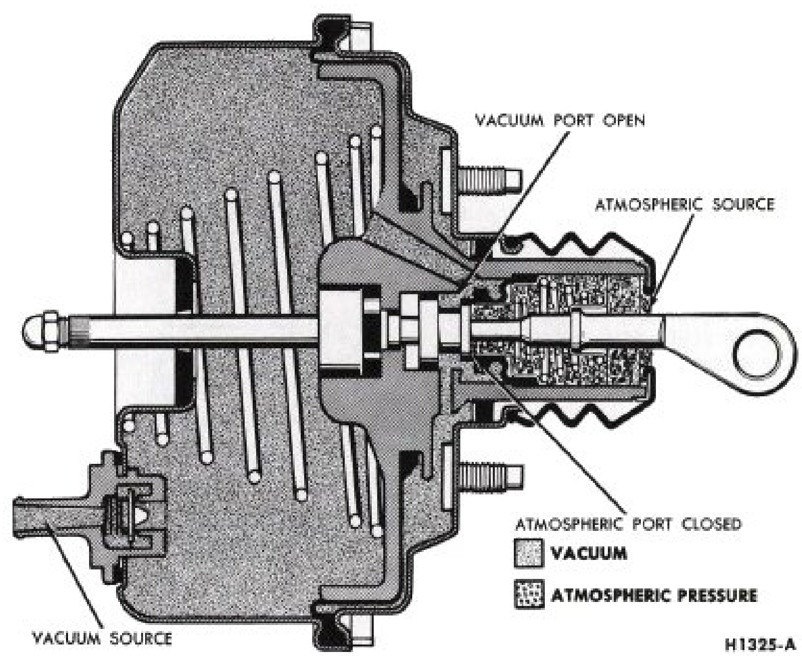


FIG. 3—Booster in Released Position

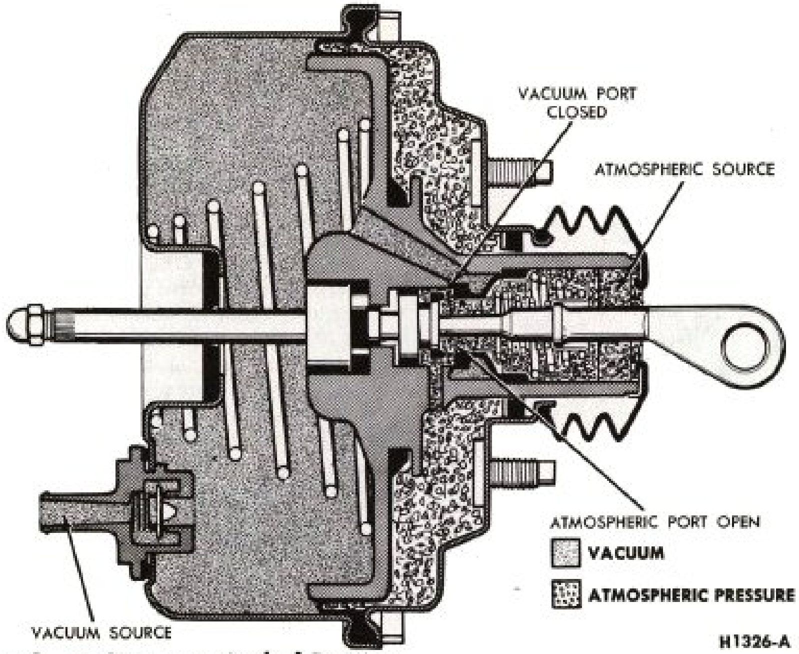


FIG. 4—Booster in Applied Position

plunger move to the left in the power diaphragm assembly to compress the valve return spring and bring the poppet valve into contact with the vacuum valve seat in the valve housing to "CLOSE" the vacuum port. Any additional movement of the valve operating rod in the applied direction moves the valve plunger away from the poppet valve to "OPEN" the atmospheric port and admit atmosphere through the air cleaner and passages in the diaphragm plate to the right side of the power chamber. With vacuum present on the left side of the diaphragm and valve housing and atmospheric pressure present on the right side of the diaphragm, a force is developed to move the vacuum power diaphragm assembly, hydraulic push rod and hydraulic piston to the left to close the compensating port and force hydraulic fluid under pressure through the residual check valve and brake tubes into the brake wheel cylinders. As hydraulic pressure is developed in the hydraulic cylinder, a counter force (to the right) acting through the hydraulic push rod, sets up a reaction force against the vacuum power diaphragm and valve plunger through the rubber reaction disc (located at the end of the hydraulic push rod). The rubber reaction disc acts similar to a column of fluid to distribute the pressure between the vacuum power diaphragm assembly and the valve plunger in proportion to their respective contact areas. The pressure acting against the valve plunger and valve operating rod tends to move the valve plunger slightly to the right in relation to the diaphragm and valve housing assembly to close off the atmospheric port. The driver is thus assured a "feel" of the brake, since part of the counter force reacts through the valve plunger, valve operating rod, and pedal linkage against the driver's foot. This reaction force is in direct proportion to the hydraulic pressure developed within the brake system.

HOLDING POSITION

During brake application, the "reaction" force which opposes the force applied by the driver, tends to close the atmospheric port. When both atmospheric and vacuum ports are CLOSED, the booster is said to be in the holding position. With both valves closed, any degree of brake application attained will be held until either the atmospheric port is **reopened** by an increase in pedal pressure to further increase the brake application or by a decrease in pedal pressure to **reopen** the vacuum port to decrease the brake application. Whenever the pressure applied to the brake pedal is held constant for a moment, the valve returns to its holding position. However, upon reaching the fully applied position the force applied to the brake pedal overrules the reaction force. In this position the valve plunger and atmospheric valve seat are held away from the valve poppet to admit maximum atmosphere pressure to the rear (right) chamber. With the front (left) chamber open to manifold vacuum, full power application is

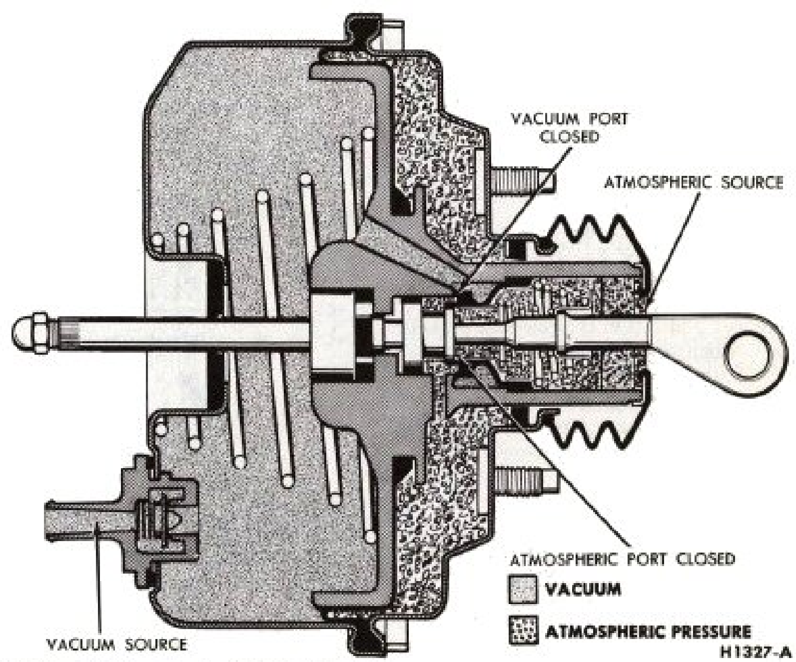


FIG. 5—Booster in Holding Position

attained which is referred to as the "run-out" of the power unit. Any increase in hydraulic pressure beyond this point must be supplied by physical effort of the driver.

NO POWER CONDITION

It should be noted that in case of engine failure and consequent loss of engine vacuum, at least one full power brake application may be made from the vacuum in the booster. With the engine off and no vacuum in the power system, the brakes can be applied in the conventional manner by applying more physical effort to the brake pedal.

PARKING BRAKES

An independent hand-operated parking brake control actuates the rear wheel brake shoes through a cable linkage. The operating cable is routed from the parking brake control assembly to the equalizer lever which is attached to the equalizer assembly. The rear brake cables connect the equalizer assembly to the parking brake lever at each rear secondary shoe as shown in Fig. 1, Part 3-1.

When the handle is pulled the primary and secondary brake shoes are forced against the rear brake drums. The handle is held in the applied position by the engagement of a spring loaded pawl with a ratchet. Turning the handle counterclockwise disengages the pawl from the ratchet to release the brakes.

2 IN-CAR ADJUSTMENTS AND REPAIRS

BRAKE SHOE ADJUSTMENTS

The car should be in a raised position with the wheels off the floor. **If the car is raised on a frame-contact hoist, disconnect the parking brake cables to prevent the rear brakes from being partially applied due to the rear axle and spring sag on the hoist.**

The hydraulic service brakes are self-adjusting and require a manual adjustment only after the brake shoes have been relined, replaced, or when the length of the adjusting screw has been changed while performing some other service operation.

The brake drums should be at normal room temperature when adjusting the brake shoes. If the shoes are adjusted when the drums are hot and expanded, the shoes may drag when the drums are cool and contracted.

1. After the shoes have been installed or the adjusting screw has been turned, install the drum. Be sure that all excess grease, oil, and other foreign material are wiped off the backing plate and drum.

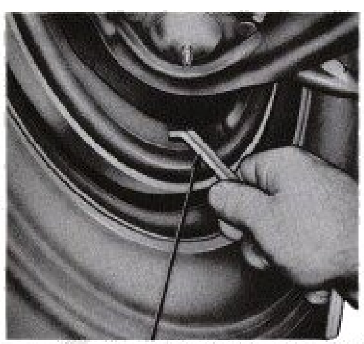


FIG. 6—Adjusting Brake Shoes

Before installing the brake drum on the front wheel spindle, wipe the spindle completely free of grease. Install the drum carefully so that the grease seal retainers within the hub will not be damaged.

2. Remove the adjusting hole cover from the backing plate. Working from the backing plate side, turn the adjusting screw upward to expand the shoes (Fig. 6). Expand the shoes until a drag is felt when the drum is rotated.

3. **Remove the drum.** Mark the tooth on the star-wheel where the adjusting lever contacts it. While holding the adjusting lever out of engagement with the adjusting screw, back off the adjusting screw ¾ of a turn with the fingers. If finger movement will not turn the screw, free it up; otherwise, the self-adjusting lever will not turn the screw. Lubricate the screw with a thin uniform coating of Stanolube – HD-Moly Grease – Grade 2.

Any other adjustment procedure may cause damage to the adjusting screw with consequent self adjuster problems.

4. Apply a small quantity of high-temperature grease to the points where the shoes contact the backing plate, being careful not to get the lubricant on the linings. Install the drum.

On front wheels, install the wheel outer bearing, washer, and adjusting nut, then adjust the wheel bearings as outlined in Part 3-4, Section 2.

On the rear wheels, install the three Tinnerman nuts and tighten securely.

5. Install the wheel on the drum and tighten the mounting nuts to specification.

6. Install the adjusting hole cover on the brake backing plate.

7. When adjusting the rear brake shoes, check the parking brake cables for proper adjustment. Make sure that the equalizer lever operates freely.

8. After the brake shoes have been properly adjusted, check the operation of the brakes.

FRONT BRAKE DRUM

REMOVAL

1. Raise the car until the wheel and tire clear the floor. Remove the wheel cover or hub cap, and remove the wheel and tire assembly from the drum.

2. If the brake drum will not come off easily, insert a narrow screwdriver through the brake adjusting hole in the backing plate, and disengage the adjusting lever from the adjusting screw. While thus holding the adjusting lever away from the adjusting screw, back off the adjusting screw with the brake adjusting tool shown in Fig. 7. **Back off the adjustment only if the drum cannot be removed. Be very careful not**

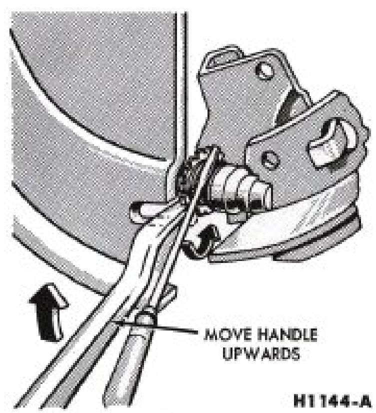


FIG. 7—Backing Off Brake Adjustment

to burr, chip, or damage the notches in the adjusting screw; otherwise, the self-adjusting mechanism will not function properly. If the adjustment was backed off, make sure that the adjuster lever is properly seated in the shoe web.

3. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone.

4. Pull the hub and drum assembly off the spindle.

INSTALLATION

1. If the drum is being replaced, remove the protective coating from the new drum with carburetor degreaser. Install new bearings and grease retainer. Soak the new grease retainer in light engine oil at least 30 minutes before installation. Pack the wheel bearings, install the inner bearing cone and roller assembly in the inner cup, and install the new grease retainer. See Part 3-4, Section 4.

If the original drum is being installed, make sure that the grease in the hub is clean and adequate.

2. Install the drum assembly, outer wheel bearing, washer and the adjusting nut.

3. Adjust the wheel bearing as outlined in Part 3-1, Section 2. Install the nut lock and cotter pin. Then install the grease cap.

4. Install the wheel and hub cap. If the adjustment was backed off, adjust the brake as outlined under "Brake Shoe Adjustments".

REAR BRAKE DRUM

REMOVAL

1. Raise the car so that the wheel is clear of the floor.

2. Remove the hub cap and wheel. Remove the three Tinnerman nuts and remove the brake drum.

If the brake drum will not come off, insert a narrow screwdriver through the brake adjusting hole in the backing plate, to disengage the adjusting lever from the adjusting screw. While holding the adjusting lever away from the adjusting screw, back off the adjusting screw with the brake adjusting tool (Fig. 7). **Back off the adjustment only if the drum cannot be removed easily. Be very careful not to burr, chip, or damage the notches in the adjusting screw which may cause malfunction in the self-adjusting mechanism.** If the adjustment was backed off, make sure that the adjuster lever is properly seated in the shoe web.

INSTALLATION

1. Remove the protective coating from a new drum with carburetor degreaser.

2. Place the drum over the brake assembly and into position. Adjust the brakes as outlined under "Brake Shoe Adjustments" in this section.

3. Install the three Tinnerman nuts and tighten them securely. Install the wheel on the axle shaft flange studs against the drum, and tighten the retaining nuts to specifications.

BRAKE SHOES AND ADJUSTING SCREW

REMOVAL

1. With the wheel and drum removed, install a clamp over the ends of the wheel cylinder as shown in Fig. 8.

2. Contract the shoes as follows:
   a. Disengage the adjusting lever from the adjusting screw by pulling backward on the adjusting lever (Fig. 1).
   b. Move the outboard side of the adjusting screw upward and back off the pivot nut as far as it will go.

3. Pull the adjusting lever, cable and automatic adjuster spring down and toward the rear to unhook the pivot hook from the large hole in the secondary shoe web. **Do not attempt to pry the pivot hook out of the hole.**

4. Remove the automatic adjuster spring and adjusting lever (Fig. 1).

5. On cars equipped with a 6-cylinder engine, remove the secondary shoe to anchor spring with the tool shown in Fig. 8. Unhook the cable eye from the anchor pin. With the same tool, remove the primary shoe to anchor spring. On cars equipped with an 8-cylinder engine, unhook the secondary and the primary shoe to anchor springs. Unhook the cable eye from the anchor pin.

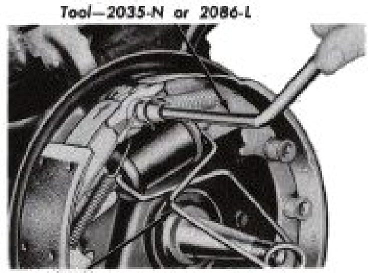


FIG. 8—Retracting Spring Removal

6. Remove the cable guide from the secondary shoe (Fig. 1).

7. Remove the shoe hold-down springs, shoes, adjusting screw, pivot nut, and socket.

8. On rear brakes, remove the parking brake link and spring. Disconnect the parking brake cable from the parking brake lever.

9. After removing the rear brake secondary shoe, disassemble the parking brake lever from the shoe by removing the retaining clip and spring washer (Fig. 1).

INSTALLATION

1. Before installing the rear brake shoes, assemble the parking brake lever to the secondary shoe and secure it with the spring washer and retaining clip.

2. Apply a light coating of high-temperature grease at the points where the brake shoes contact the backing plate.

3. Position the brake shoes on the backing plate and secure them with the hold down springs. On the rear brake, install the parking brake link and spring. Connect the parking brake cable to the parking brake lever.

4. On a car equipped with an 8-cylinder engine, position the adjuster cable eye over the anchor pin with the crimped side toward the backing plate.

Install the cable guide on the secondary shoe web with the flanged hole properly fitted into the hole in the secondary shoe web. Install the secondary shoe to anchor spring. Install the primary shoe to anchor spring.

5. On a car equipped with a 6-cylinder engine, install the cable guide on the secondary shoe web with the flanged hole properly fitted into the hole in the secondary shoe web. Install the secondary shoe to anchor spring (Fig. 1).

Place the cable eye over the anchor pin with the crimped side toward the backing plate. Install the primary shoe to anchor spring with the tool shown in Fig. 9.

6. Thread the cable around the cable guide groove.

It is imperative that the cable be positioned in this groove and

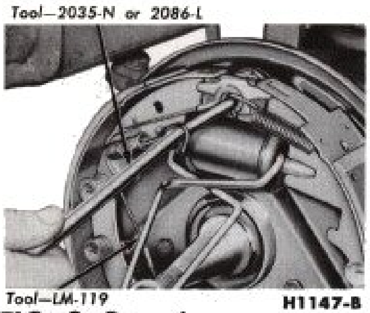


FIG. 9—Retracting Spring Installation

not between the guide and the shoe web. Be certain that the cable eye is not cocked or binding on the anchor pin when installed. All parts should be flat on the anchor pin. Remove the brake cylinder clamp.

7. Apply high-temperature grease (Stanolube Poly) to the threads and the socket end of the adjusting screw. Turn the adjusting screw into the adjusting pivot nut to the limit of the threads and then back off ½ turn.

Interchanging the brake shoe adjusting screw assemblies from one side of the car to the other would cause the brake shoes to retract rather than expand each time the automatic adjusting mechanism operated. To prevent accidental installation of the adjusting screw on the wrong side of the car the socket end of the adjusting screw is stamped with an R or L (Fig. 10). The adjusting pivot nuts can be distinguished by the number of grooves machined around the body of the nut. Two grooves indicate a right-hand nut; one groove indicates a left-hand nut.

8. Place the adjusting socket on the screw and install this assembly between the shoe ends with the adjusting screw toothed wheel nearest the secondary shoe.

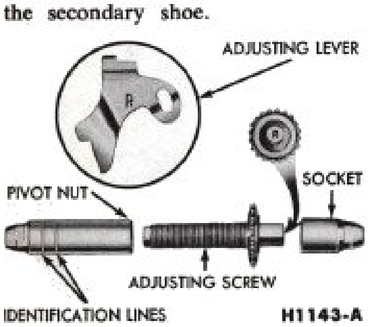


FIG. 10—Adjusting Screw and Lever Identification

9. Hook the cable hook into the hole in the adjusting lever. The adjusting levers are stamped with an R or L to indicate their installation on a right- or left-hand brake assembly (Fig. 10).

10. Position the hooked end of the adjuster spring completely into the large hole in the primary shoe web. The last coil of the spring should be at the edge of the hole. Connect the loop end of the spring to the adjuster lever hole (Fig. 1).

11. Pull the adjuster lever, cable and automatic adjuster spring down and toward the rear to engage the pivot hook in the large hole in the secondary shoe web.

12. After installation, check the action of the adjuster by pulling the section of the cable between the cable guide and the adjusting lever toward the secondary shoe web far enough to lift the lever past a tooth on the adjusting screw wheel. The lever should snap into position behind the next tooth, and release of the cable should cause the adjuster spring to return the lever to its original position. This return action of the lever will turn the adjusting screw one tooth.

If pulling the cable does not produce the action described, or if the lever action is sluggish instead of positive and sharp, check the position of the lever on the adjusting screw toothed wheel. With the brake in a vertical position (anchor at the top), the lever should contact the adjusting wheel 3/16 inch (plus or minus 1/32 inch) above the centerline of the screw. If the contact point is below this centerline, the lever will not lock on the teeth in the adjusting screw wheel, and the screw will not be turned as the lever is actuated by the cable.

To determine the cause of this condition:

a. Check the cable end fittings. The cable should completely fill or extend slightly beyond the crimped section of the fittings. If it does not meet this specification, possible damage is indicated and the cable assembly should be replaced.

b. Check the cable length. The cable should measure 8 11/16 inches on 6-cylinder models or 10⅛ inches on 8-cylinder models from the end of the cable anchor to the end of the cable hook.

c. Check the cable guide for damage. The cable groove should be parallel to the shoe web, and the body of the guide should lie flat against the web. Replace the guide if it shows damage.

d. Check the pivot hook on the lever. The hook surfaces should be square with the body of the lever for proper pivoting. Replace the lever if the hook shows damage.

e. See that the adjusting screw socket is properly seated in the notch in the shoe web.

WHEEL CYLINDER REPAIR

It is not necessary to remove the wheel cylinder from the backing plate to disassemble, inspect, or hone and overhaul it. Removal is necessary only when the cylinder is damaged or scored beyond repair.

DISASSEMBLY

1. Remove the links and the rubber boots from the ends of the wheel cylinder. The 6-cylinder models are not provided with links. Remove the pistons, cups, and return spring from the cylinder bore (Fig. 11).

2. Remove the bleeder screw from the cylinder.

INSPECTION

1. Wash all parts in clean denatured alcohol. If alcohol is not available, use specified brake fluid. Dry with compressed air.

2. Check all internal parts for excessive wear or damage. **If any of the internal parts require replacing, all should be replaced.**

3. Inspect the cylinder bore for score marks or rust. If either condition is present, the cylinder bore must be honed. **However, the cylinder should not be honed more than 0.003 inch beyond its original diameter.** A baffle in the front wheel cylinder of the 6-cylinder models prevents honing; therefore, they must be replaced.

4. Check the bleeder hole to be sure that it is open.

ASSEMBLY

1. Apply a coating of heavy-duty brake fluid to all internal parts.

2. Thread the bleeder screw into the cylinder and tighten securely.

3. Insert the return spring, cups, and pistons into their respective positions in the cylinder bore (Fig. 11). Place a boot over each end of the cylinder.

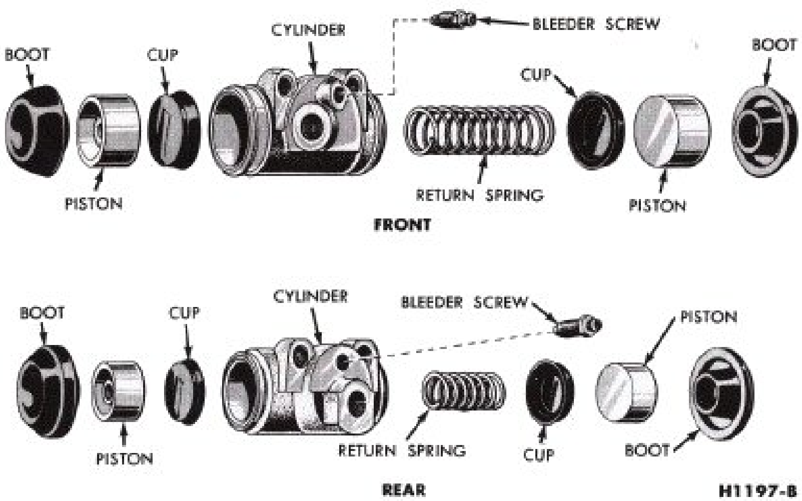


FIG. 11—Front and Rear Wheel Cylinders

WHEEL CYLINDER REPLACEMENT

REMOVAL

1. With the wheel in a raised position, remove the wheel and the drum.

2. Place a clamp over the ends of the wheel cylinder as shown in Fig. 9.

4. Remove the brake shoe assemblies, following procedures outlined in this section.

4. Disconnect the brake line from the brake cylinder. **On a car with a vacuum brake booster, be sure the engine is stopped and there is no vacuum in the booster system before disconnecting the hydraulic lines.**

To disconnect the hose at a front cylinder, loosen the tube fitting that connects the opposite end of the hose to the brake tube at a bracket on the frame. Remove the horseshoe-type retaining clip from the hose and bracket, disengage the hose from the bracket, then unscrew the entire hose assembly from the front wheel cylinder.

At a rear cylinder, unscrew the tube fitting that connects the tube to the cylinder. **Do not pull the metal tube away from the cylinder. Pulling the tube out of the cylinder connection will bend the metal tube and make installation difficult.** The tube will separate from the cylinder when the cylinder is removed from the backing plate.

5. Remove the wheel cylinder attaching bolts and lock washers and remove the cylinder.

INSTALLATION

Wipe the end(s) of the hydraulic line to remove any foreign matter before making connections.

1. **To install a front cylinder:**

   a. Position the cylinder in place against the backing plate. Install the two lock washers and attaching bolts. Torque them to specifications.

   b. Install a new copper gasket over the hose fitting. Thread the hose assembly into the cylinder and tighten it securely.

   c. Engage the opposite end of the hose to the bracket on the frame, install the horseshoe-type retaining clip, and connect the brake tube to the hose with the tube fitting nut. Tighten the nut to specifications.

2. **To install a rear cylinder:**

   a. Position the rear wheel cylinder in place against the backing plate. Enter the tubing into the cylinder, and start the tube fitting nut into the threads of the cylinder.

   b. Secure the cylinder to the backing plate with the attaching bolts and lock washers.

   c. Tighten the tube fitting nut to specifications.

3. Install the links in the ends of the wheel cylinder (8-cylinder models only).

4. Install the brake shoes as detailed in this section.

5. Install the brake drums and wheels.

6. Bleed the brakes as detailed in Part 2-1, Section 2.

7. Adjust the brakes as detailed in Part 2-2, Section 2.

BRAKE BACKING PLATE REPLACEMENT

REMOVAL

1. Remove the wheel and brake drum. Disconnect the brake line from the brake cylinder.

2. Remove the brake shoe and adjuster assemblies and the wheel cylinder as outlined in this section. On the rear wheels, disconnect the parking brake lever from the cable.

3. If the rear backing plate is being replaced, rotate the axle shaft so that the hole in the axle shaft flange lines up with the backing plate retaining nuts and remove the nuts. Pull the axle shaft assembly out of the housing with tool #4235-C and a slide hammer (Part 4-2), then remove the backing plate.

If the front backing plate is being replaced, remove the bolts and nuts that secure the plate to the front wheel spindle and remove the plate.

INSTALLATION

1. Position a new **rear** backing plate on the retaining bolts in the axle housing flange. Insert the axle shaft into the housing so that the splines engage the differential side gear with the bearing retainer sliding onto the retaining bolts and against the backing plate. Install the retaining nuts through the access hole in the axle shaft flange.

Position a new **front** backing plate to the wheel spindle and install the retaining bolts and nuts.

2. Install the wheel cylinder and connect the brake line as outlined in this section.

3. Install the brake shoe and adjuster assemblies as outlined in this section. On a rear brake, connect the parking brake cable to the lever. Install the brake drum and wheel.

4. Adjust the brake shoes (Section 2), and bleed the brake system as outlined in Part 2-1, Section 2.

HYDRAULIC LINES

Steel tubing is used throughout the brake system with the exception

of the flexible hoses at the front wheels and at the rear axle housing brake tube connector (Fig. 12).

Always bleed the entire hydraulic system after any hose or line replacement.

BRAKE TUBE REPLACEMENT

If a section of the brake tubing becomes damaged, the entire section should be replaced with tubing of the same type, size, shape, and length. **Copper tubing should not be used in a hydraulic system.** When bending brake tubing to fit underbody or rear axle contours, be careful not to kink or crack the tube.

All brake tubing should be flared properly to provide good leak-proof connections. Clean the brake tubing by flushing with clean denatured alcohol, before installation.

When connecting a tube to a hose, tube connector, or brake cylinder, tighten the tube fitting nut to specified torque with Milbar tool 1112-144 or equivalent.

BRAKE HOSE REPLACEMENT

A flexible brake hose should be replaced if it shows signs of softening, cracking, or other damage.

When installing a new front brake hose, position the hose to avoid contact with other chassis parts. Place a new copper gasket over the hose fitting and screw the hose assembly into the front brake cylinder. Engage the opposite end of the hose to the bracket on the frame. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut.

A rear brake hose should be installed so that it does not touch the muffler outlet pipe or shock absorber.

Place a new gasket over the rear hose fitting and screw the hose assembly into the rear brake tube connector. Engage the front end of the hose to the bracket on the frame. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut.

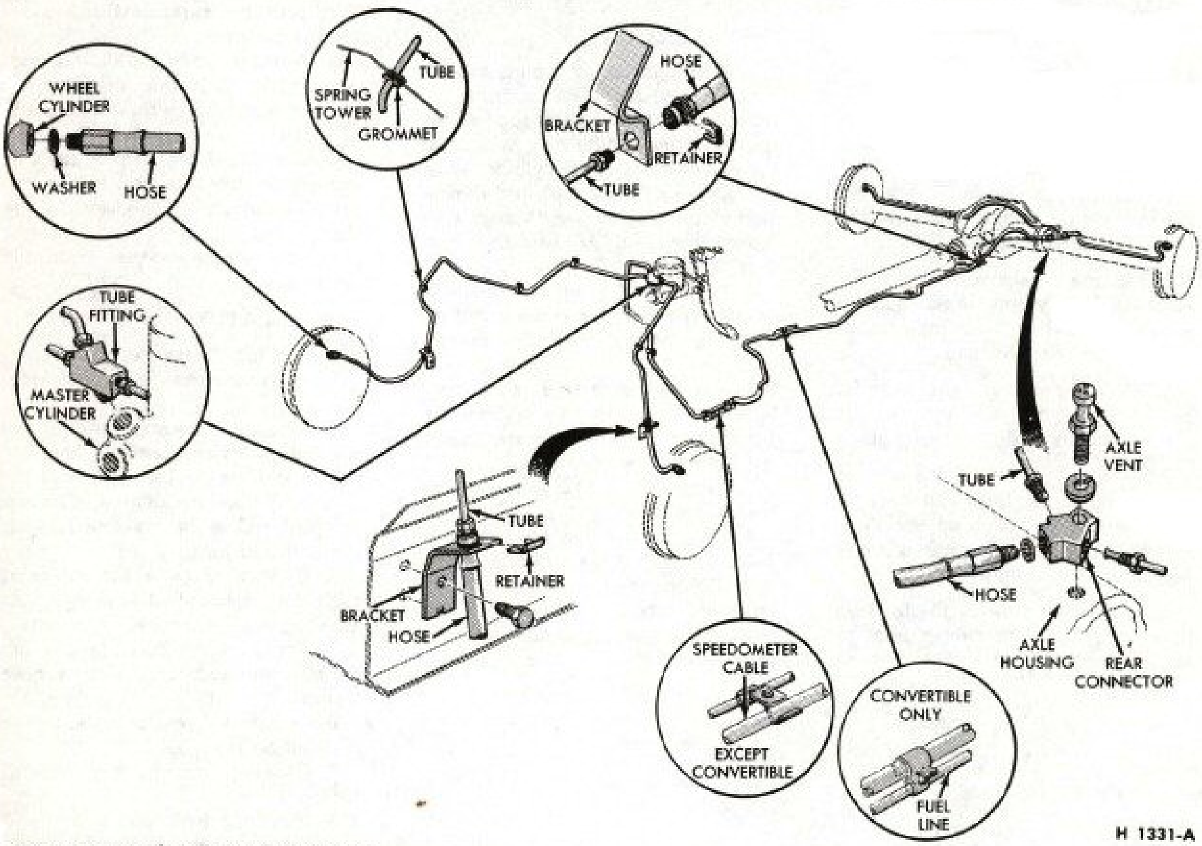


FIG. 12—Hydraulic Brake System

3 REMOVAL AND INSTALLATION

MASTER CYLINDER—STANDARD BRAKES

REMOVAL

1. Disconnect the rubber boot from the rear end of the master cylinder in the passenger compartment.
2. Disconnect the brake line from the master cylinder. Disconnect the stop light switch wires from the switch (Fig. 13).
3. Remove the bolts that secure the master cylinder to the dash panel and lift the cylinder out and away from the push rod. Remove the rubber boot from the push rod.

INSTALLATION

1. With the rubber boot on the push rod, guide the master cylinder over the end of the push rod, and position the cylinder against the dash panel.
2. Install and torque the mounting

FIG. 13—Brake Master Cylinder Installed

bolts to specification.

3. Connect the brake line to the master cylinder fitting, but leave the brake line fitting loose.

4. Fill the master cylinder reservoir with heavy-duty brake fluid to within ⅜ inch of the top. Install and tighten the filler cap.

5. Bleed the master cylinder to let air escape from the cylinder at the brake line fitting. Then tighten the fitting.

6. Remove the filler cap and fill the reservoir to the level specified. Install the cap and wipe off any fluid from the cylinder.

7. Connect the wires to the stop light switch and the rubber boot to the master cylinder.

MASTER CYLINDER—POWER BRAKES

REMOVAL

1. Disconnect the battery ground cable from the battery.
2. Disconnect the stop light switch wires from the switch.
3. Disconnect the hydraulic line from the master cylinder and from the multiple fitting on the bridge (Fig. 14). Disconnect the three remaining lines from the fitting.
4. Remove the two nuts and lock washers that attach the master cylinder to the booster.
5. Remove the bridge and the master cylinder from the vacuum booster.

INSTALLATION

1. Before installing the master cylinder, check the distance from the outer end of the push rod to the master cylinder mounting surface at the end of the vacuum cylinder (Fig. 3, Part 2-1). If the push rod dimension is not correct, see "Master Cylinder Push Rod Adjustment," Part 2-1, Section 2.
2. Position the master cylinder over the push rod onto the two studs that are integral with the booster body.
3. Position the bridge and the tail light wire clip (Fig. 13) on the studs. Install, but do not tighten the attaching nuts and lock washers.
4. Connect the hydraulic lines to the multiple fitting.
5. Connect the line from the cylinder to the multiple fitting.
6. Tighten the two master cylinder attaching nuts.
7. Tighten all hydraulic line fittings.

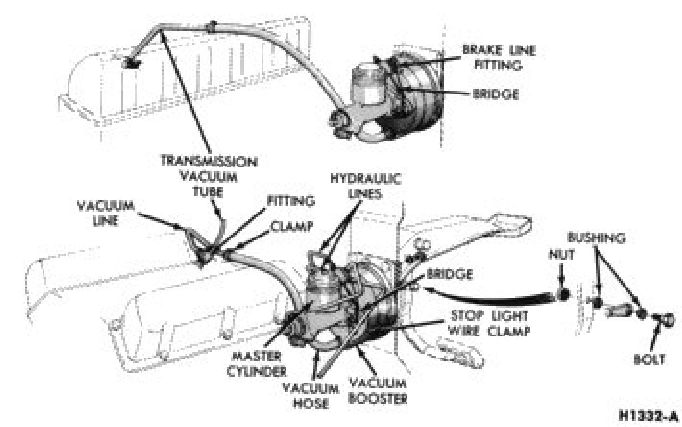


FIG. 14—Vacuum Booster Installation

8. Connect the stop light switch wires to the switch.
9. Bleed the brake system. Fill the master cylinder to ⅜ inch from the top of the filler opening. Install the filler cap and gasket.

VACUUM BOOSTER

REMOVAL

1. Disconnect the battery ground cable.
2. Remove the master cylinder from the booster.
3. Disconnect the vacuum hose from the booster.
4. If working on a car equipped with an eight-cylinder engine, remove the left valve rocker arm cover to provide clearance when removing the booster.
5. Working from inside the car, remove the bolt that attaches the booster push rod to the brake pedal (Fig. 14).
6. Working from inside the car, remove the five nuts and lock washers that attach the booster to the dash panel.
7. Remove the booster from the dash panel.

INSTALLATION

1. Position the booster and mounting bracket on the dash panel (Fig. 14).
2. Secure the booster with the five attaching nuts and lock washers.
3. Lubricate the bushings with engine oil before installation. Connect the push rod to the brake pedal with the bolt and bushing.
4. If working on a car equipped with an eight-cylinder engine, install the left valve rocker arm cover.
5. Connect the vacuum hose to the booster and secure it with a hose clamp.
6. Install the master cylinder as detailed on this page.
7. Connect the battery ground cable.
8. Bleed the hydraulic system and check the operation of the booster.

BRAKE PEDAL—MANUAL SHIFT TRANSMISSION

REMOVAL

1. Back off the clutch pedal over-center spring adjusting nut and disconnect the equalizer rod. Remove the clutch pedal bumper, and the over-center spring bracket from the support bracket.
2. Remove the over-center adjusting nut and bolt. Remove the brake

push rod, bushings and retaining clip.

3. Remove the clip (Fig. 15) from the clutch and brake pedal shaft and remove the clutch pedal, brake pedal, and bushings.

INSTALLATION

1. Dip the bushings in engine oil and install them in the brake pedal. Hold the brake pedal in place on the support.

2. Insert the clutch pedal shaft through the brake pedal support bracket, brake pedal, and install the washer retaining clip (Fig. 15).

3. Connect the clutch pedal rod to the clutch pedal, and adjust the free travel.

4. Secure the brake push rod to the pedal with the bushings retaining clip.

5. Connect the clutch link to the release lever. Adjust the over-center spring nut to the correct stud length specifications.

BRAKE PEDAL—AUTOMATIC TRANSMISSION

REMOVAL

1. Remove the retainer clip and bushings from the brake pedal pin and disconnect the brake pedal push rod. If vehicle is equipped with power brakes, remove the nut, bushings, bolt and disconnect the brake pedal push rod.

2. Remove the retaining clip from the end of the brake pedal shaft, and remove the spring washer and nylon thrust washer.

3. Remove the brake pedal shaft. Remove the shaft bushing and remove the pedal.

4. Remove the brake pedal pad and the pedal bumper.

INSTALLATION

1. Install the brake pedal pad and the bumper on the pedal assembly.

2. Dip the pedal bushings in engine oil and install them in the brake pedal. Hold the brake pedal in place on the support. Install the brake pedal shaft. Insert the spacer washer.

3. Install the brake pedal shaft nylon washer.

4. Install the nylon bushing, spring washer, and the retaining clip (Fig. 15) on the pedal shaft.

5. Install the bushings in the push rod and connect the push rod to the pedal pin and install the retaining clip. On power brakes, install the bushings in the push rod and connect the push rod to the pedal with the nut and bolt.

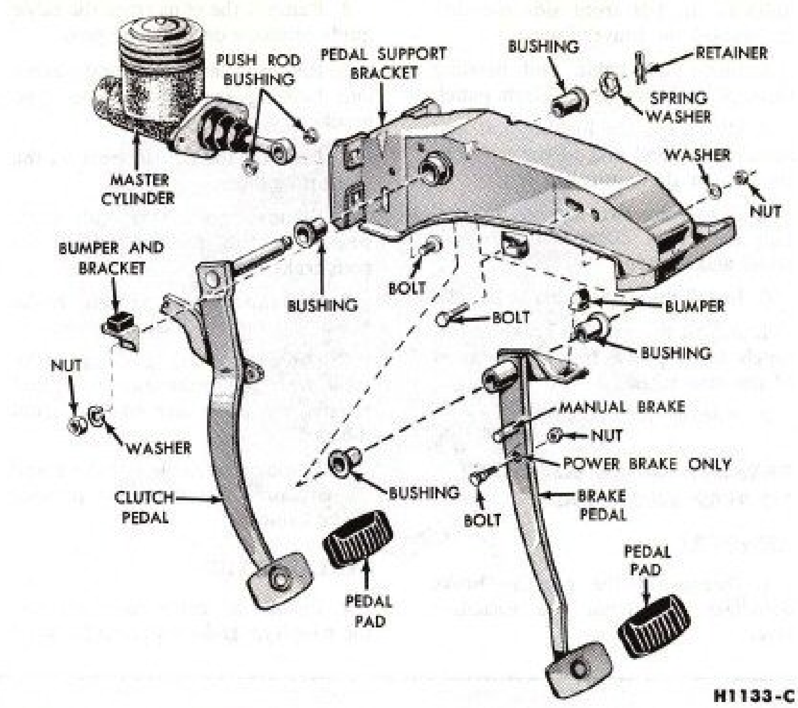


FIG. 15—Brake Pedal and Related Parts

PARKING BRAKE HANDLE

REMOVAL

1. Remove the two screws that hold the handle bracket on the instrument panel. Remove the two screws that secure the cable clamp to the dash panel.

2. Remove the two nuts and lock washers that secure the control to the dash panel.

3. Remove the clevis pin that secures the pulley to the control handle assembly.

4. Disengage the locking rod and remove the ball on the cable from the slot in the control assembly.

INSTALLATION

1. Disengage the locking rod and connect the ball end of the cable to the slot on the control assembly.

2. Assemble the pulley to the control handle and the clevis pin.

3. Position the assembly against the dash panel and instrument panel. Secure the assembly to the instrument panel with the two screws.

4. Secure the cable and clamp to the dash panel with two screws.

5. Working from under the left front fender, install the two lock washers and attaching nuts.

PARKING BRAKE EQUALIZER TO HANDLE CABLE

REMOVAL

1. Remove the two screws that attach the cable clamp to the dash panel.

2. Remove the parking brake handle assembly.

3. Disengage the locking rod and remove the ball on the cable from the slot in the control assembly.

4. Push the cable down through the hole in the dash panel.

5. From the underside of the car, remove the cable and housing from the holes in the left front side member. If working on a convertible remove the cable from the bracket.

6. Remove the horseshoe-type clip and remove the cable from the hole in the frame crossmember or torque box on convertibles.

7. Loosen the adjusting nut on the equalizer bar and remove the cable.

INSTALLATION

1. Thread the cable through the crossmember or torque box on convertibles and install the hairpin clip. Attach the rear of the cable to the equalizer bar.

2. Thread the forward end of the cable and housing through the two

holes in the left front side member or bracket on convertibles.

3. Insert the cable and housing through the hole in the dash panel.

4. Disengage the locking rod and connect the ball end of the cable to the slot in the control assembly.

5. Install the two screws that retain the cable clamp to the dash panel and tighten.

6. Install the parking brake handle.

7. Adjust the parking brake at one notch to stop the forward rotation of the rear wheels.

8. Release the handle.

PARKING BRAKE EQUALIZER TO REAR WHEEL CABLE

REMOVAL

1. Disconnect the parking brake equalizer rod from the equalizer lever.

2. Remove the clips from the cable guide brackets on the floor pan.

3. Remove the parking brake cable and housing from the clamp type brackets.

4. Back off the adjustments on the rear brake shoes.

5. Remove both rear hub caps, wheel and tire assemblies, and the rear brake drums.

6. Disconnect the parking brake housings from the backing plates.

7. Disconnect the parking brake cable from the brake shoe lever, and remove the cable and housing from the car.

8. Remove the cable equalizer and the equalizer rod from the parking brake cable.

INSTALLATION

1. Install the cable equalizer and the equalizer rod on the cable.

2. Install the ends of the cable through the holes in the backing plates and connect the brake shoe levers.

3. Connect the parking brake housings to the backing plate.

4. Install the rear drums, wheel and tire assemblies, and hub caps.

5. Install the cable and housing in the clamp type brackets.

6. Install the cable in the guide brackets on the floor pan and insert the cotter pins.

7. Attach the parking brake equalizer rod to the equalizer lever.

8. Adjust the rear brake shoes, and then adjust the equalizer rod to three notches to stop the forward rotation of the rear wheels.

9. Release the handle.

4 MAJOR REPAIR OPERATIONS

BRAKE DRUM REFINISHING

The 6-cylinder models are equipped with 9-inch brake drums and the 8-cylinder are equipped with 10-inch drums.

Minor scores on a brake drum can be removed with a fine emery cloth. A drum that is excessively scored or shows a total indicator runout of over 0.007 inch should be turned down. Remove only enough stock to eliminate the scores and true up the drum. The refinished diameter must not exceed 0.060 inch oversize.

If the drum diameter is less than 0.030 inch oversize (9.030 inches 6-cylinder, or 10.030 inches 8-cylinder) after refinishing, standard lining may be installed. If the drum diameter is more than 9.030 inches or 10.030 inches, oversize linings must be installed.

After a drum is turned down, wipe the refinished surface with a cloth soaked in clean denatured alcohol. If one drum is turned down, the opposite drum on the same axle should also be cut down to the same size.

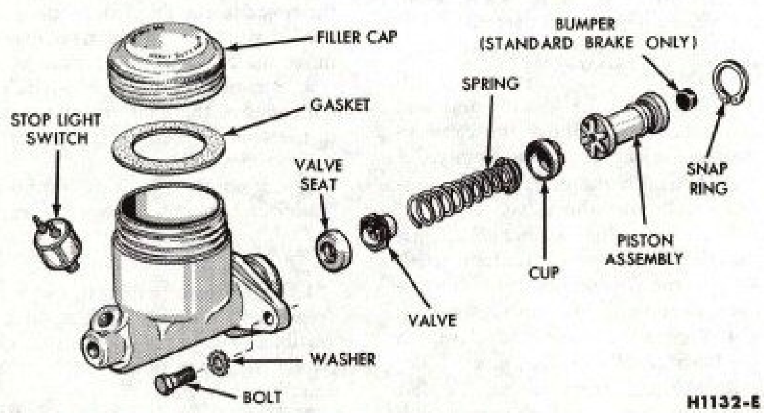


FIG. 16–Brake Master Cylinder Disassembled

BRAKE SHOE RELINING

Brake linings that are worn to within 1/32 inch of any rivet or have been saturated with grease or oil should be replaced. Failure to replace worn linings will result in a scored drum. **When it is necessary to replace linings, they must also be replaced on the wheel on the opposite side of the car.**

Inspect brake shoes for distortion, cracks, or looseness. If this condition exists, the shoe should be discarded. **Do not repair a defective brake shoe.**

1. Wash the brake shoes thoroughly in a clean solvent. Remove all burrs or rough spots from the shoes.

2. Check the inside diameter of the brake drum. If the diameter is less than 9.030 or 10.030 inches, standard lining may be installed. If the diameter is 9.030 to 9.060 or 10.030 to 10.060 inches, oversize lining should be installed.

3. Position the new lining on the shoe. Starting in the center, insert and secure the rivets, working alternately towards each end. Install all parts supplied in the kit. **Genuine replacement linings are ground**

and no further grinding is required.

4. Check the clearance between the shoe and lining. The lining must seat tightly against the shoe with not more than .005 inch clearance between any two rivets.

MASTER CYLINDER DISASSEMBLY

1. Clean the outside of the cylinder, and remove the filler cap and gasket. Pour out any remaining fluid.

2. Remove the stop light switch, brake fitting, and gaskets (Fig. 16).

3. Remove the snap ring from the push rod end of the cylinder.

4. Remove the piston, cup, spring, valve assembly, and valve seat.

5. Remove the rubber bumper from the piston.

MASTER CYLINDER ASSEMBLY

1. Dip all parts except the cylinder body in clean **heavy-duty** brake fluid.

2. Install the brake fitting (Fig. 16) on the forward end of the cylinder.

3. Thread the stop light switch into the cylinder and tighten it securely.

4. Insert the valve seat, valve and spring assembly, cup, and piston into the cylinder bore.

5. Compress the piston against the valve spring and install the snap ring.

6. Install the rubber bumper in the piston (standard brakes only).

MASTER CYLINDER INSPECTION AND REPAIR

1. Clean all parts in clean denatured alcohol and inspect the parts for wear or damage, replacing them as required. When using a master cylinder repair kit, install all of the parts supplied.

2. Check all openings to be sure they are open and free from foreign matter.

3. Check the spring valve at the forward end of the piston. If the spring is loose or has moved so that the piston ports are open, replace the piston.

4. Inspect the cylinder bore for score marks or rust. If either condition is present, the cylinder should be honed. When honing, **do not remove more than 0.003 inch as oversize parts are not available.**

5. Remove any burrs or loose metal that may have resulted from honing. Then clean the cylinder with denatured alcohol.

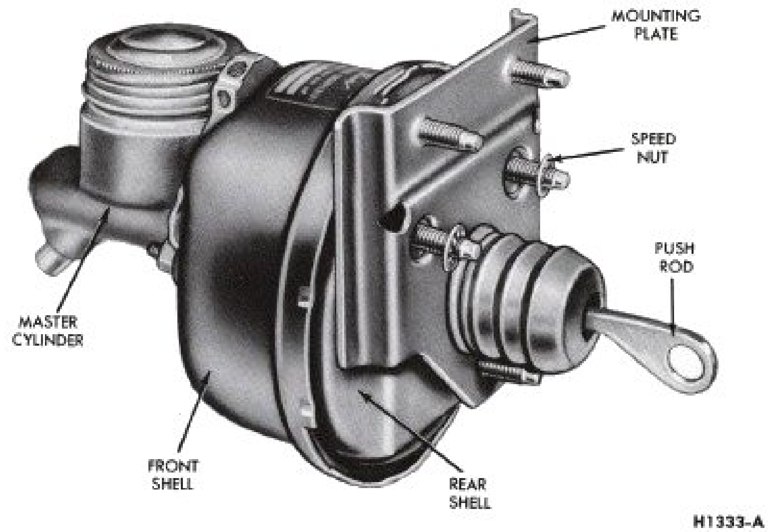


FIG. 17—Vacuum Booster

DISASSEMBLY OF BOOSTER

1. Remove the speed nuts that attach the mounting plate (Fig. 17) to the rear shell and remove the plate.

2. Pull the push rod and front seal (Fig. 18) from the front shell.

3. Scribe an index mark across the front and rear shells.

4. Place the booster in a vise as shown in Fig. 20. Press downward on the rear shell and at the same time, turn it counterclockwise with a flat bar to release it from the front shell. Release the pressure on the rear shell slowly to prevent the diaphragm plate return spring from flying out.

5. Separate the two shells and remove the return spring.

6. Withdraw the diaphragm plate and diaphragm from the front shell.

7. Remove the diaphragm from the diaphragm plate as shown in Fig. 21.

8. Pry the filter retainer off the diaphragm plate being careful not to chip or damage the plate.

9. Hold the diaphragm plate so that the valve retainer is facing downward. Press the valve push rod inward to release the tension on the retainer and allow it to drop out of the plate (Fig. 22).

10. Withdraw the valve and rod from the plate.

11. Press the reaction disc out of the diaphragm plate.

12. Pry the seal retainer (Fig. 19) out of the rear shell.

13. Lift the bearing and the seal from the rear shell.

14. Working from the inside of the front shell, cut the bead off the check valve grommet. Remove the check valve.

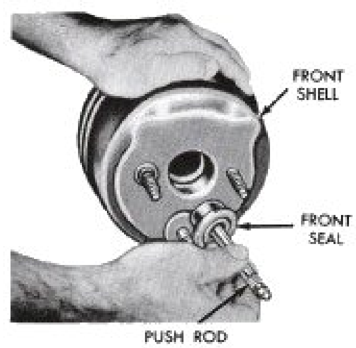


FIG. 18—Removing Front Seal and Push Rod

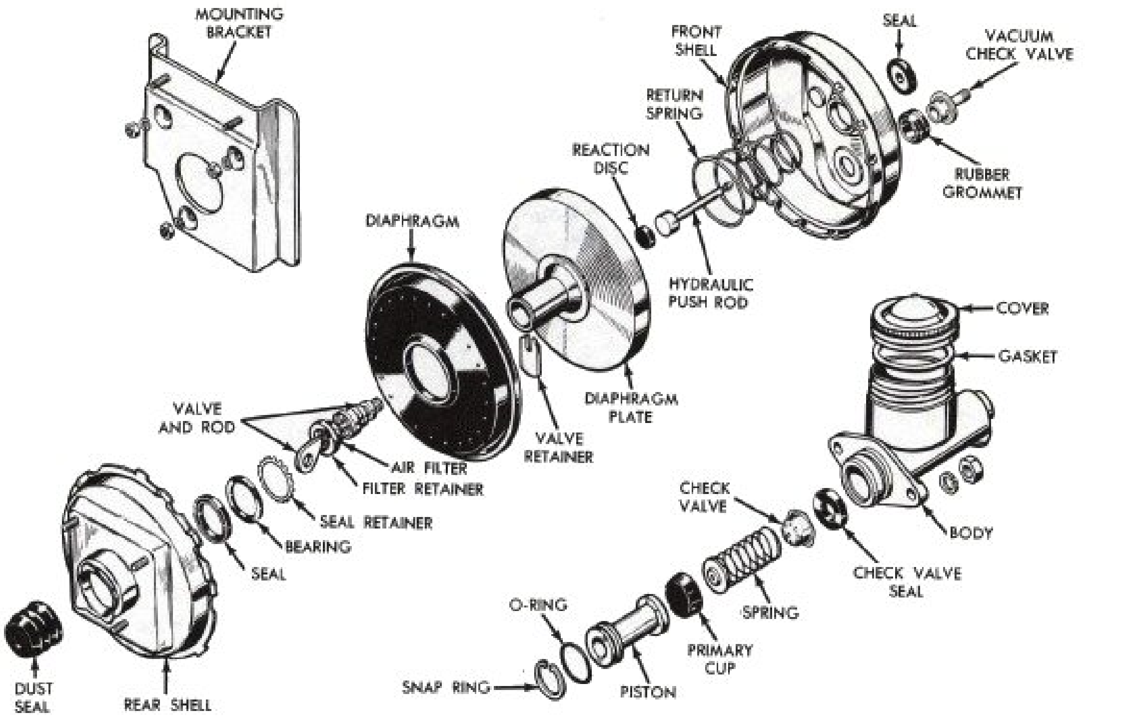


FIG. 19—Vacuum Booster Disassembled

CLEANING AND INSPECTION

After disassembly, immerse all metal parts in cleaning solvent. Plastic parts should be cleaned **only** in alcohol. Care should be taken to prevent chipping of/or damage to plastic parts. All rubber parts should be replaced. After parts have been thoroughly cleaned, those parts which come in contact with brake fluid should be rewashed in clean alcohol before reassembly. Use an air hose to blow out dirt and cleaning solvent

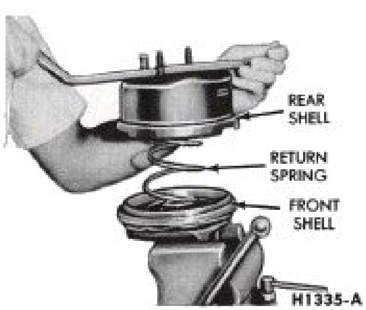


FIG. 20—Separating Booster Shells

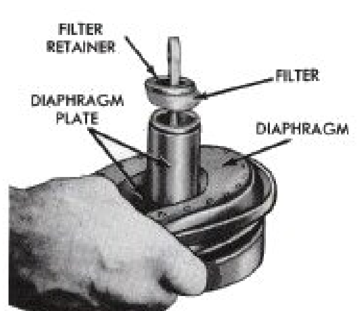


FIG. 21—Removing Diaphragm

from recesses and internal passages. When overhauling a vacuum booster use all parts furnished in the repair kit.

ASSEMBLY OF BOOSTER

1. Place the rear shell on two wood blocks as shown in Fig. 23. Position a new seal with the lip facing down and the bearing in the shell. Press the seal retainer into the shell to a depth of $\frac{17}{64}$ inch.

2. Dip a new check valve grommet (Fig. 19) in alcohol and install it in the front shell making sure that the beveled edge is toward the inside. Make sure that the grommet is seated. Dip the shoulder of the check

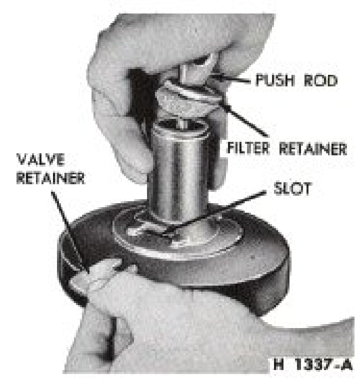


FIG. 22—Removing Valve Retainer

valve in alcohol and install it in the grommet. Press check valve into grommet until the flange contacts the grommet.

3. Apply silicone grease to the outer surface of the diaphragm plate hub and to the bearing and rubber surfaces of the valve.

4. Insert the valve and rod into the hub of the diaphragm plate. Press it on the rod until the retainer can be slid into the retaining groove.

5. Tuck the filter into place in the plate hub. Press the filter retainer onto the hub being careful not to chip or damage the plastic.

6. Place the rear shell in a vise. Apply silicone lubricant generously to the top outer flange of shell. Apply silicone grease to the bearing and the seal in the rear shell.

7. Carefully guide the valve rod and diaphragm plate hub through

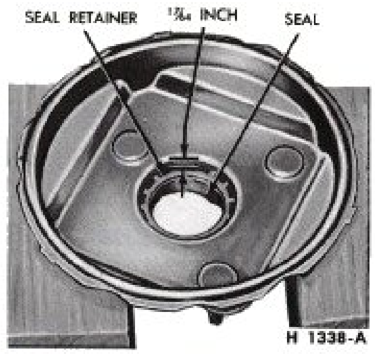


FIG. 23—Installing Rear Shell Seal

the bearing and seal in the rear shell.

8. Center the large end of the return spring on the diaphragm plate.

9. Align the index mark on the front shell with the one on the rear shell. Place a flat bar on the front shell and compress the spring until the tangs on the rear shell contact the diaphragm, then rotate it clockwise to lock it in place.

10. Apply lubricant sparingly to stem of hydraulic push rod keeping it away from the adjusting screw area. Apply silicone grease liberally to the piston area of the push rod and to the reaction disc.

11. Center the reaction disc on the push rod piston. Guide the disc and push rod into base of diaphragm plate and press on the rod to bottom the disc.

12. Press a new seal into front shell until it bottoms in the recess.

13. Install a new dust seal over push rod and onto the rear shell.

14. Position the mounting plate on the rear shell and secure it in place with speed nuts.

PART 2-3 SPECIFICATIONS

TORQUE LIMITS—BRAKES

Description	Foot-Pounds
Brake Cylinder to Brake Backing Plate Bolt	5-7
Hand Brake Control Assembly to Instrument Panel Bolt	8-12
Master Cylinder to Dash Panel Bolt	20-25
Hand Brake Control Assembly to Dash Panel Bolt	8-12
Brake Hose Bolt	12-18
Brake Pedal Support Bracket to Dash Panel Bolt	20-25
Brake Pedal Support Bracket to Instrument Panel Nut	9-13
FRONT BRAKES ONLY	
Wheel Assembly to Wheel Hub and Drum Assembly Nut	55-85
Wheel, Hub and Drum Assembly to Wheel Spindle Nut*	17-25
Backing Plate to Spindle Nut	25-45
REAR BRAKES ONLY	
Axle Housing to Backing Plate Lock Nut	25-35
Drum to Axle Shaft Assembly Speednut	Hand Push Fit
Wheel Assembly to Axle Shaft to Drum Assembly Nut	55-85
Brake Line Connection to Axle Housing Bolt	12-18
Bleeder Screw to Wheel Cylinder	20-45 Inch-Pounds
Master Cylinder Cover	Finger Tight
Master Cylinder Mounting Bolts	20-25
Pedal Pad to Brake Pedal Nut	12-16
Control Assembly—Parking Brake to Cowl Side Bolt	15-19
Master Cylinder Fitting Bolt	30-40
Left Hand Brake Hose—Front to Connector Bolt	12-18
POWER BRAKES	
Vacuum Manifold to Booster Body Mounting Bolt	8-10
Master Cylinder to Booster Body	10-13
Brake Booster to Dash Panel	12-15
Push Rod to Brake Pedal Bolt	10-15

*.0005 to .0065 Bearing end play at assembly.

TORQUE LIMITS—BRAKES (Cont'd)

Description	Foot-Pounds
FRONT BRAKES	
Wheel Assembly to Hub and Drum Assembly Nuts	75-110
Brake Backing Plate to Spindle Nuts	25-35
REAR BRAKES	
Drum Assembly to Axle Shaft Assembly Speednut	Hand Push Fit
Wheel Assembly to Axle Shaft to Drum Assembly Nuts	75-110
Brake Cylinder to Brake Backing Plate Bolt	5-7
Brake Backing Plate to Axle Housing	25-35

DIMENSIONS

Description	
Master Cylinder Bore Diameter	1.000"
Master Cylinder Maximum Allowable Hone	0.003"
Front Wheel Cylinder Bore Diameter:	
6-Cylinder Engine	1.062"
8-Cylinder Engine	1.125"
Rear Wheel Cylinder Bore Diameter:	
6-Cylinder Engine Sedan and Hardtop	0.812"
Convertibles and Station Wagons	0.875"
8-Cylinder Engine All Except Station Wagon	0.906"
Station Wagon	0.938"
Wheel Cylinder Maximum Allowable Hone	0.003"
Drum Diameter:	
6-Cylinder Engine	9.0"
8-Cylinder Engine	10.0"
Drum Maximum Allowable Run-Out	0.007"
Drum Maximum Boring Diameter:	
6-Cylinder Engine	9.060"
8-Cylinder Engine	10.060"

SUSPENSION, STEERING, WHEELS AND TIRES — GROUP 3

PART 3-1 SUSPENSION, STEERING, WHEELS AND TIRES GENERAL SERVICE

1 DIAGNOSIS AND TESTING

MANUAL STEERING

Table 1 lists various steering gear and linkage trouble symptoms and possible causes. Several of these symptoms are also common to suspension frame, and wheel and tire troubles. For this reason, be sure that the cause of the trouble is in the steering gear or linkage before adjusting, repairing, or replacing any of the steering parts.

POWER STEERING

PRELIMINARY TESTS

The following preliminary checks should always be made before performing any trouble-shooting operations.

Check Pump Belt. If the pump belt is broken, glazed, or worn, replace with a new belt. **Use only the specified type of belt.**

Check the belt tension. If the belt is too loose or too tight, it should be adjusted to the proper tension as follows:

Do not try to increase belt tension by pulling on the reservoir.

In the following procedure, a "used belt" is one that has run 15 minutes or longer.

1. Check the power steering belt tension, using tool T63L-8620-A. See Part 3-6 for specified tension on new and on used belts.

2. If necessary, loosen the power steering pump bracket adjusting bolt and the pivot bolt.

3. Increase or decrease tension as required by adjusting the pump position.

4. Torque the adjusting bolt and the pivot bolt to specification, and check the power steering belt tension.

Check Fluid Level. Start the engine, turn the steering wheel all the way to the left and right several times, and shut off the engine.

Check the fluid level in the reservoir. If the level is low, add enough fluid to raise the level to a point one inch from the top on remote mounted reservoirs or to the F mark on the dipstick. **Do not overfill the reservoir.**

Check For Fluid Leaks.

1. If the power steering fluid does not already include yellowish green dye, pre-mix one teaspoonful of oil-soluble aniline dye with 2 pints of automatic transmission fluid. Then refill the reservoir with the dye solution.

2. With the engine running at idle speed, turn the steering wheel all the way to the right stop and to the left stop several times to distribute the dye solution throughout the hydraulic system. Do not hold the wheel against each wheel stop for more than 3 to 5 seconds.

3. Shut off the engine, and check for leaks.

FITTING AND TUBE SEAT LEAK. Since most fluid leaks occur at the fittings and connections in a power steering hydraulic system, these parts should be checked before any other part is replaced.

1. With the engine running at idle speed, raise the car on a hoist.

2. Clean the outside of the control valve and the power cylinder, the bottom surfaces of the pump, and all lines and fittings. Dirt, oil, and grease should be removed from all areas where leaks may exist.

3. Tighten all fittings, using a special 5-flat tube wrench. **Do not tighten the fittings with a standard open end wrench.** If a properly

tightened fitting leaks, replace the seat.

PUMP, CONTROL VALVE, AND POWER CYLINDER LEAK. If the fittings and connections do not leak, check the other parts of the system.

PUMP RESERVOIR LEAKS. Leak points at the pump reservoir may be caused by improper installation or by a worn or defective cover gasket. A worn or damaged stud gasket on the stud at the center of the cover may also cause leakage.

Check the hose connection at the reservoir for leaks, and tighten the hose clamp if necessary.

PUMP LEAKS. Leakage may occur at the O-rings in the orifices at the top of the pump body. The reservoir or pump adapter must be removed from the pump to replace these O-rings. Pump with adapters have only one "O" ring.

Other pump leak points are the shaft seal at the front of the pump, the pump housing O-ring and the other O-ring between the two halves of the pump, and the relief valve retainer O-ring. Replace only the defective parts as required.

CONTROL VALVE LEAKS. If the control valve is leaking (somewhere other than the tube seats), replace all the seals, using a control valve seal kit. Use all the parts in the kit, and be sure they are correctly installed. When assembling the new seals in the valve, an application of silicone grease to the internal parts will help to provide a better seal against future leakage. Apply grease to the centering spring area, especially on the cap and spacer mating surfaces. Coat the threads of the cap retaining bolts with grease. The rubber boot seals, the actuator assembly, and the metal cup seals in the control valve should also be coated with silicone grease.

Some oil remaining from the manufacturing processes may be found in the sleeve near the ball stud. Do not confuse this oil with leaking fluid from the hydraulic system.

POWER CYLINDER LEAKS. The power cylinder may leak at the piston rod seals. A power cylinder seal kit should be used to correct leakage. **Do not replace the power cylinder assembly unless the piston rod is scored or has a dull gray finish instead of a high luster chrome finish.**

Check Turning Effort. With the front wheels properly aligned and tire pressures correct, check the effort required to turn the steering wheel.

1. With the car on dry concrete, set the parking brakes.

2. With the engine warmed up and running at idle speed, turn the steering wheel to the left and right several times to warm the fluid.

3. Attach a pull scale to the steering wheel (Fig. 1). Check the effort required to turn the wheel at least one complete revolution in both directions. See Part 6-3 for the specified torque which should be approximately equal in both directions.

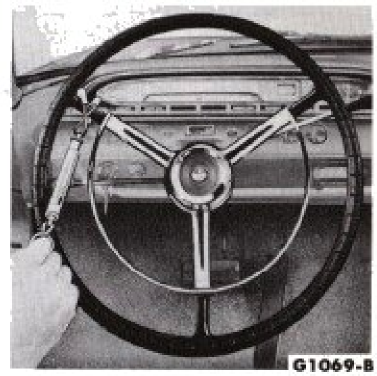


FIG. 1—Checking Turning Effect—Typical

TROUBLE DIAGNOSIS GUIDE

BINDING OR POOR RECOVERY	If the steering wheel binds or sticks when turned, or if poor recovery to the straight-ahead position occurs, check the Pitman arm ball stud in the control valve sleeve. If the ball stud is rubbing against the edge of the sleeve slot, the roll pin may be missing. If either of the idler arm bushings is worn or damaged, replace both bushings. Check the steering gear adjustments (Section 2). Check the operation of the control valve spool in the valve housing. If the spool is binding in the housing, check the spool adjustment. If the adjustment is correct, overhaul or replace the control valve. Check the control valve travel regulator stop adjustment. If the stop is drawn up too tightly, the ball stud will bind in the seats. Adjust the stop as required. Check the control valve sleeve and the socket tube for damage. Replace parts that show signs of damage, and adjust the travel regulator stop. Check for possible interference between the steering wheel and the steering column.
HARD STEERING	If the effort required to turn the steering wheel is greater than normal for the entire travel of the front wheels, check the tire pressure then, test the fluid pressure. Be sure that there are no leaks, that the reservoir is properly filled, and that the belt is properly adjusted. If the pump output pressure is low, the pump may be defective and should be overhauled or replaced. If the pressure test shows that the trouble is in the control valve or power cylinder, remove and inspect these units. Repair or replace any damaged parts. If the pressure test indicates that the pressures throughout the system

CONTINUED ON NEXT PAGE

TROUBLE DIAGNOSIS GUIDE (Continued)

HARD STEERING (Continued)	are within specifications, check the following items in the order given: Check the control valve spool centering spring adjustment. Adjust if required (Section 3). Check the control valve spool for movement. If the spool does not move freely, check for, and eliminate, interference between the socket tube and the valve sleeve. If the spool is sticking in the housing, remove the spool and check the spool	lands for burrs. Small burrs may be removed with crocus cloth if the edges of the valve lands are not rounded in the process. If the spool cannot be repaired, replace the control valve. Check the control valve ball stud for free movement in the ball stud seats. If the stud is binding in the seats, adjust the travel regulator stop. If the hard steering still persists, check the front end alignment.
EXCESSIVE FREE PLAY	If excessive free play or lost motion is noticed when steering, check the steering gear worm and ball nut mesh adjustment. Check for excessive clearance between the steering arm ball stud and the ball stud seats. If the ball stud is loose in the seats, adjust the con-	trol valve travel regulator stop. Check the control valve centering spring adjustment. If the spring adjusting nut is loose, tighten the nut until it is snug, and then back off the nut not more than ¼ turn. **Excessive tightening may damage the stop pin.**
NOISE	Check the pump belt tension. A loose or glazed belt can cause belt squeal. A glazed belt, even when properly adjusted, may slip. Excessive torque at the pressure line joints may distort the tube seats and cause noise.	Noise may result if the specified hose is not used or if it is improperly routed. If noise still exists with the specified hose properly installed and routed, the pump should be removed from the car and inspected.
STEERING CHATTER	A loose pump belt or air in the fluid can cause chatter against the wheel stops during an extremely sharp turn. Check the belt tension, and adjust it to specifications or fill the reservoir if necessary. Check for looseness in the idler arm rod connection. Looseness at this point may be due to worn mounting bushings or improper	mounting nut torque. Replace the bushings if worn. Torque the nut to specification. Check the power cylinder piston rod insulators for looseness. If the insulators are worn, replace them. If the mounting nut is loose, torque it to specification, and torque the locknut to specification.
RATTLES	Check the control valve spool centering spring adjustment. If the adjustment is loose, tighten the nut until snug, and then back off the nut not more than ¼ turn. **Excessive tightening may damage the stop**	**pin.** Check for looseness between the control valve ball stud and the ball stud seats. If the stud is loose in the seats, adjust the travel regulator stop.
LOSS OF POWER ASSIST	Check the entire system for damage, replacing parts as necessary. Tighten a loose pump belt. Test the fluid pressure to determine whether the trouble is in the pump, the control valve, or the power cylinder. If the pressure test indicates that the pump is at fault, remove and overhaul or replace the pump. If the pressure test indicates that the control valve or power cylinder is at fault, check as follows: Disconnect the power cylinder piston rod from the idler arm bracket. Operate the piston by hand to check	for resistance to movement. If the piston moves easily with little or no resistance, the internal parts of the power cylinder are broken or damaged. Replace the power cylinder if broken or damaged. Maladjustment of the control valve spool centering spring can cause a loss of either right or left power assist. Check the adjustment, and readjust if necessary. Replace all defective parts. Check the operation of the control valve check valve. If the check valve does not operate freely, replace the check valve assembly.

TABLE 1—Trouble Symptoms and Possible Causes

POSSIBLE CAUSES OF TROUBLE															
TROUBLE SYMPTOMS	Jerky Steering	Loose Steering	Hard Steering and/or Loss of Power Assist	Hard Turning When Stationary	Steering and Suspension Noises	Shimmy or Wheel Tramp	Pull to One Side	Side-to-Side Wander	Body Sway or Roll	Tire Squeal on Turns	Binding or Poor Recovery	Abnormal or Irregular Tire Wear	Sag at One Wheel	Hard or Rough Ride	Rear Suspension Misalignment (Dog-Tracking)
1. Incorrect Tire Pressure			X	X		X	X	X	X	X	X	X	X	X	
2. Tire Sizes Not Uniform			X	X			X	X		X		X	X		
3. Overloaded or Unevenly Loaded Vehicle							X	X				X	X	X	
4. Power Steering Fluid Level Low-Leak	X		X	X	X										
5. Sagging or Broken Spring					X		X	X	X			X	X	X	
6. Glazed, Loose or Broken Power Steering Pump Belt	X		X	X	X										
7. Rear Spring Tie Bolt Off Center							X					X			X
8. Broken Rear Spring Tie Bolts					X	X	X	X	X			X			X
9. Rear Spring Front Hanger Mislocated							X					X			X
10. Bent Spindle Arm							X	X		X		X			
11. Bent Spindle							X	X		X		X			
12. Lack of Lubrication			X	X	X						X			X	
13. Air in Power Steering System	X		X		X	X									
14. Obstruction in Power Steering Lines			X	X	X										
15. Loose or Weak Shock Absorber					X	X		X	X			X		X	
16. Loose or Worn Suspension Arm Bushings					X	X						X		X	
17. Binding Front Suspension Ball Joints or Steering Linkage	X		X	X	X						X			X	
18. Loose, Worn, or Damaged Steering Linkage or Connections	X	X			X	X		X		X		X			
19. Loose Steering Gear Mountings	X	X			X	X		X							
20. Insufficient Steering Pump Pressure			X	X							X				
21. Incorrect Steering Gear Adjustment	X	X	X	X	X	X		X	X		X	X			
22. Incorrect Brake Adjustment	X				X		X					X			
23. Incorrect Front Wheel Bearing Adjustment	X	X			X	X	X	X				X			
24. Wheel Out of Balance	X					X						X		X	
25. Incorrect Front Wheel Alignment			X		X	X	X	X		X	X	X			
26. Out-of-Round Wheel or Brake Drum						X						X		X	
27. Frame or Underbody Out of Alignment							X					X			X
28. Bent Rear Axle Housing					X		X					X			X
29. Excessive Wear of Steering Pump Internal Parts			X		X										
30. Steering Gear Valve Spool Binding or out of Adjustment			X	X			X				X				
31. Obstruction Within Steering Gear	X		X	X							X				

FLUID PRESSURE TEST

A fluid pressure test will show whether the pump or some other unit in the power steering system is causing trouble in the system.

1. Disconnect the pressure line hose from the pump outlet, and install the pressure testing tool between the hose and the pump outlet (Fig. 2). **Be sure that the pressure gauge is between the pump and the shut-off valve on the tool.**

2. Open the shut-off valve on the testing tool, and run the engine at idle speed. **If the pump normally operates quietly, ignore the louder pump noise when the pressure testing tool is connected to the system.** Allow at least two minutes for the fluid to warm up before starting the pressure tests.

3. Turn the front wheels all the way to the right and then to the left, noting the fluid pressure reading on the gauge when each wheel is against its stop.

Normal pressure is 750-900 psi. **Do not hold a wheel against its stop for more than three to five seconds at a time because the fluid may overheat.**

4. If the fluid pressure, with a wheel against its stop, is less than 750 psi turn the wheel off the stop. Slowly close the testing tool shut-off valve, and watch the gauge for an increase in pressure. **Do not leave the valve closed for more than three to five seconds.**

5. If the fluid pressure, with the shut-off valve fully closed, still shows less than 750 psi, the pump is causing the trouble. If the pressure increases to normal pressure range, the trouble is in either the control valve or power cylinder.

6. After the fluid pressure test is complete, shut off the engine and remove the pressure testing tool. Make the necessary repairs or replacements to eliminate the trouble in the system.

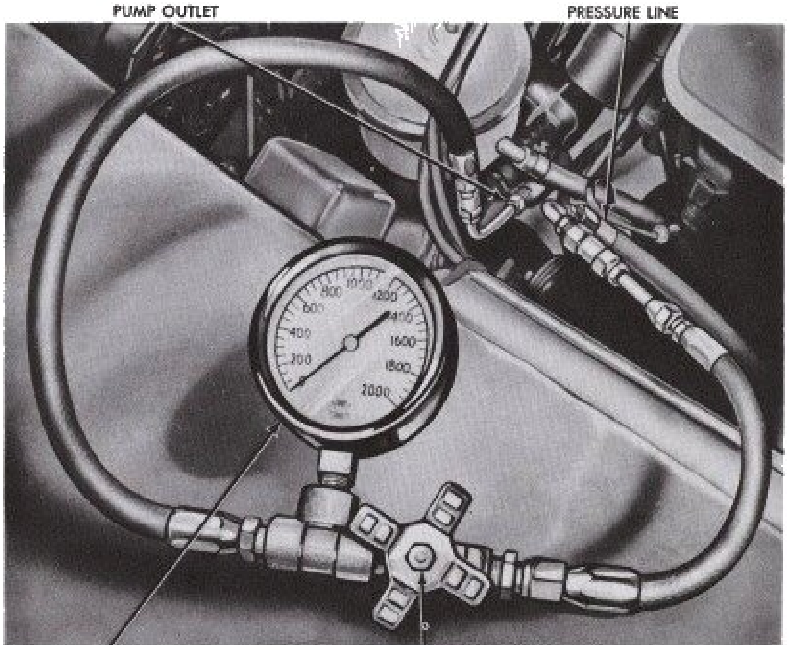


FIG. 2—Pressure Testing Tool Installed

2 COMMON ADJUSTMENTS AND REPAIRS

FRONT WHEEL ALIGNMENT CHECKS

Do not attempt to check and adjust front wheel alignment without first making a preliminary inspection of the front-end parts.

Check all the factors of front wheel alignment except toe-out on turns before making any adjustments. Toe-out on turns should be checked only after caster, camber, and toe-in have been adjusted to specifications.

EQUIPMENT INSTALLATION

Equipment used for front wheel alignment inspection must be accurate. If portable equipment is being used, perform all inspection operations on a level floor.

1. Drive the car in a straight line far enough to establish the straight-ahead position of the front wheels, and then mark the steering wheel hub and the steering column collar (Fig. 3). **Do not adjust the steering wheel spoke position at this time.** If the front wheels are turned at any time during the inspection, align the marks to bring the wheels back to the straight-ahead position.

2. Install the wheel alignment equipment on the car. Whichever type of equipment is used, follow the installation and inspection instructions provided by the equipment manufacturer.

CASTER

Check the caster angle at each front wheel.

Caster is the forward or rearward tilt of the top of the wheel spindle. If the spindle tilts to the rear, caster is positive. If the spindle tilts to the front, caster is negative. The correct caster angle, or tilt, is $\frac{1}{2}° \pm \frac{1}{2}°$. The maximum difference between

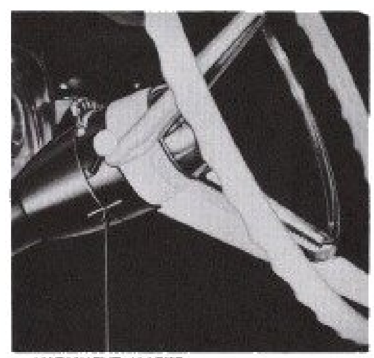


FIG. 3—Straight Ahead Position Marks—Typical

both front wheel caster angles should not exceed ½°. However, a difference of not more than ¼° is preferred.

CAMBER

Check the camber angle at each front wheel.

Camber is the amount the front wheels are tilted at the top. If a wheel tilts outward, camber is positive. If a wheel tilts inward, camber is negative. The correct camber angle, or outward (positive) tilt, is +½° ±½°. The maximum difference between both front wheel camber angles should not exceed ½°. However, a difference of not more than ¼° is preferred.

TOE-IN

Check the toe-in with the front wheels in the straight-ahead position. **Run the engine so that the power steering control valve will be in the center (neutral) position.** Measure the distance between the extreme front and also between the extreme rear of both front wheels. The difference between these two distances is the toe-in.

Correct toe-in, or inward pointing of both front wheels at the front, is ¼-5/16 inch.

Front Wheel Turning Angle

Six-cylinder—The turning angle of an outside wheel should be 20⅛° with P/S and 19⅛° with manual steering when the inside wheel is turned 20°.

FIG. 4—Caster and Camber Adjustments

Eight-cylinder—The turning angle of an outside wheel should be 18⅞° when the inside wheel is turned 20°.

After front wheel alignment factors have been checked, make the necessary adjustments. **Do not attempt to adjust the front wheel alignment by bending the suspension or steering parts.**

CASTER AND CAMBER ADJUSTMENTS

Caster and camber can be adjusted by removing or installing shims between the inner shaft of the front suspension upper arm and the underbody (Fig. 4).

Both caster and camber adjustments can be made at the same time by loosening the nuts on the two bolts that fasten the inner shaft to the underbody. After the required shims have been removed or installed, torque the nuts to specification. Caster and camber adjusting shims are available in 1/32-inch and ⅛-inch thickness.

The 1/32 inch shims should be placed against the fender housing sheet metal or between the ⅛ inch shims.

CASTER

To adjust caster, remove or install shims at either the front bolt or the rear bolt (Fig. 4).

The removal of shims at the front bolt or the installation of shims at the rear bolt will cause the upper ball joint to move forward. The removal of shims at the rear bolt or the installation of shims at the front bolt will cause the ball joint to move rearward. A 1/32-inch change of shim thickness at either bolt will change the caster angle approximately ½°. The difference between the shim stack thickness at the two bolts should not exceed 1/16 inch (Fig. 4).

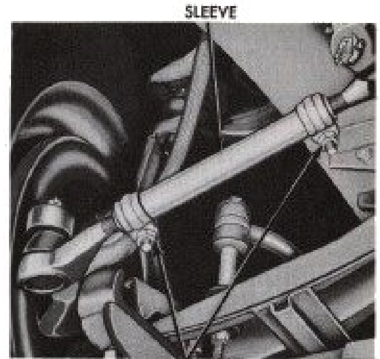


FIG. 5—Spindle Connecting Rod Sleeve

CAMBER

To adjust camber, remove or install equal shim thicknesses at both bolts (Fig. 4).

The removal of equal shims at both bolts will move the upper ball joint inward. The installation of equal shims at both bolts will move the ball joint outward. A 1/16-inch change of shim thickness at both bolts will change the camber angle ⅓°. The total shim stack thickness at each bolt should not exceed 9/16-inch (Fig. 4).

TOE-IN AND STEERING WHEEL ALIGNMENT ADJUSTMENTS

Check the steering wheel spoke position when the front wheels are in the straight-ahead position. If the spokes are not in their normal position, they can be properly adjusted while toe-in is being adjusted.

1. Loosen the two clamp bolts on each spindle connecting rod sleeve (Fig. 5).

2. Adjust toe-in. If the steering wheel spokes are in their normal position, lengthen or shorten both rods

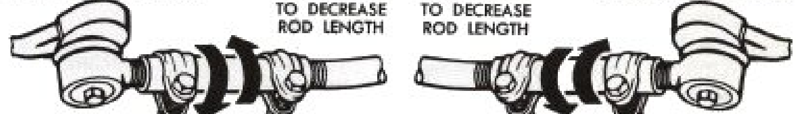


FIG. 6—Spindle Connecting Rod Adjustment

equally to obtain correct toe-in (Fig. 6). If the steering wheel spokes are not in their normal position, make the necessary rod adjustments to obtain correct toe-in and steering wheel spoke alignment (Fig. 7).

3. Recheck toe-in and steering wheel spoke alignment. If toe-in is correct and the steering wheel spokes are still not in their normal position, turn both connecting rod sleeves upward or downward the same number of turns to move the steering wheel spokes (Fig. 7).

4. When toe-in and steering wheel spoke alignment are both correct torque the clamp bolts on both connecting rod sleeves to specification. **The sleeve position should not be changed when the clamp bolts are tightened.**

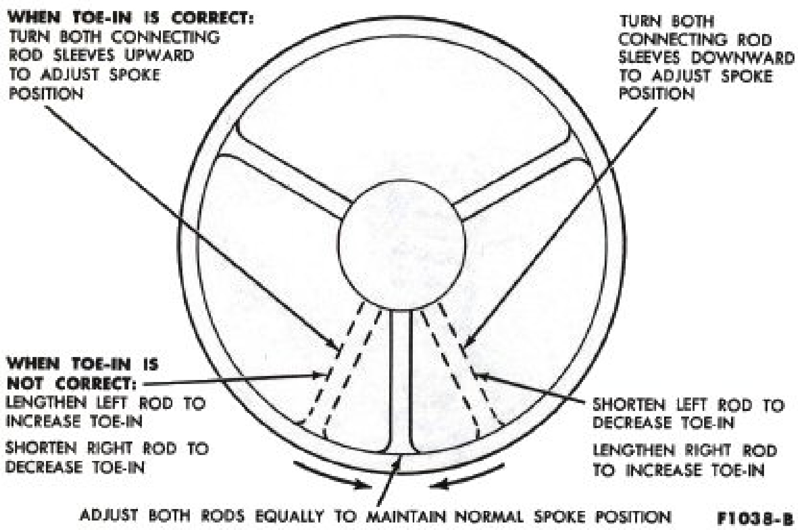


FIG. 7—Toe In and Steering Wheel Spoke Alignment Adjustment

LUBRICANT CHECKING PROCEDURE

1. Center the steering wheel.

2. Remove the steering gear housing filler plug.

3. Remove the **upper** cover-to-housing attaching bolt.

4. With a **clean** punch or like instrument, clean out or push inward the loose lubricant in the filler plug hole and cover to housing attaching bolt hole.

5. Slowly turn the steering wheel to the **right** stop, lubricant should rise within the **upper** cover bolt hole; then slowly turn the steering wheel to the **left** stop, lubricant should rise within the filler plug hole. If lubricant does not rise in both the cover bolt hole and the filler plug hole, add lubricant until it comes out both holes during this check.

6. Install the upper cover-to-housing attaching bolt.

3 CLEANING AND INSPECTION

STEERING GEAR CLEANING AND INSPECTION

Wash all parts in a cleaning solvent, dry with a lint-free cloth. **The bearing should not be spun dry with compressed air.** Inspect the shaft and worm for scoring, cracks or checks, and for straightness of the shaft. Check the splines and the threads on the sector shaft for wear and burrs. Inspect the gear teeth for scoring, pitting and other wear. Inspect the ball bearings for free movement, and the cups for wear or irregular surfaces. Check the housing for cracks and the sector shaft needle bearing for free movement or other wear.

FRONT END GENERAL INSPECTION

Do not check and adjust front wheel alignment without first making the following inspection for front-end maladjustment, damage, or wear.

1. Check for specified air pressures in all four tires.

2. Raise the front of the car off the floor. Shake each front wheel grasping the upper and lower surfaces of the tire to check the front suspension ball joints and mountings for looseness, wear, and damage. Check the brake backing plate mountings. Torque all loose nuts and bolts to specifications. Replace all worn parts as outlined in Part 3-2.

3. Check the steering gear mountings and all steering linkage connections for looseness. Torque all mountings to specifications. If any of the linkage is worn or bent, replace the parts as outlined in Part 3-3.

4. Check the front wheel bearings. If any in-and-out free play is noticed, adjust the bearings to specification (Part 3-5). Replace worn or damaged bearings as outlined in Part 3-5.

5. Spin each front wheel with a wheel spinner, and check and balance each wheel as required.

6. Check the action of the shock absorbers. If the shock absorbers are not in good condition, the car may not settle in a normal, level position, and front wheel alignment may be affected.

WHEEL INSPECTION

Wheel hub nuts should be tightened to specification at the pre-delivery inspection. Loose wheel hub nuts may cause shimmy and vibration. Elongated stud holes in the wheels may also result from loose hub nuts.

Keep the wheels and hubs clean. Stones wedged between the wheel and drum and lumps of mud or grease can unbalance a wheel and tire.

Check for damage that would affect the runout of the wheels. Wobble or shimmy caused by a damaged wheel will cause premature tire wear and eventually damage the wheel bearings. Inspect the wheel rims for dents that could permit air to leak from the tires.

PART 3-2 SUSPENSION

1 DESCRIPTION AND OPERATION

FRONT SUSPENSION

Each front wheel rotates on a spindle. The upper and lower ends of the spindle are attached to upper and lower ball joints which are mounted to an upper and lower arm respectively. The upper arm pivots on a bushing and shaft assembly which is bolted to the underbody. The lower arm pivots on a bolt that is located in an underbody bracket (Fig. 1).

A coil spring seats between the upper arm and the top of the spring housing. A double acting shock absorber is bolted to the arm and the top of the spring housing.

The swiveling action of the ball joints allows the wheel and spindle assemblies to move up and down with changes in road surface. The swiveling ball joints also permit the spindles and wheels to be turned to the left or right by the steering gear and linkage.

The pivoting action of the suspension arms provides an up and down movement for the spindles and wheels as required by bumps or depressions in the road surface. The coil springs, shock absorbers and stabilizer bar control the front suspension up and down movements. The struts, which are connected between the suspension lower arms and the underbody prevent the suspension arms from moving forward and backward.

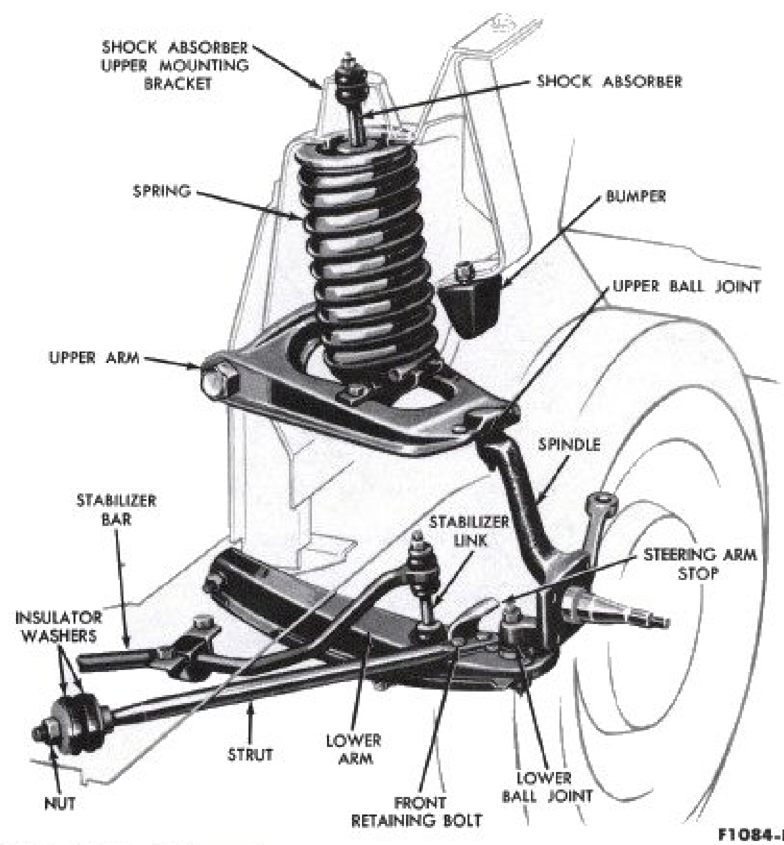


FIG. 1—Front Suspension

REAR SUSPENSION

Each rear wheel, hub and brake drum assembly is bolted to the rear axle shaft flange. The wheel and axle shaft assembly rotates in the rear axle housing. Two spring pads integral with the axle housing, rest on two leaf type springs. The axle housing is fastened to the springs by spring clips (U-bolts), spring clip plates and nuts (Fig. 2). Each spring is suspended from the underbody side rail by a hanger at the front and a shackle at the rear. The upper end of each shock absorber is mounted

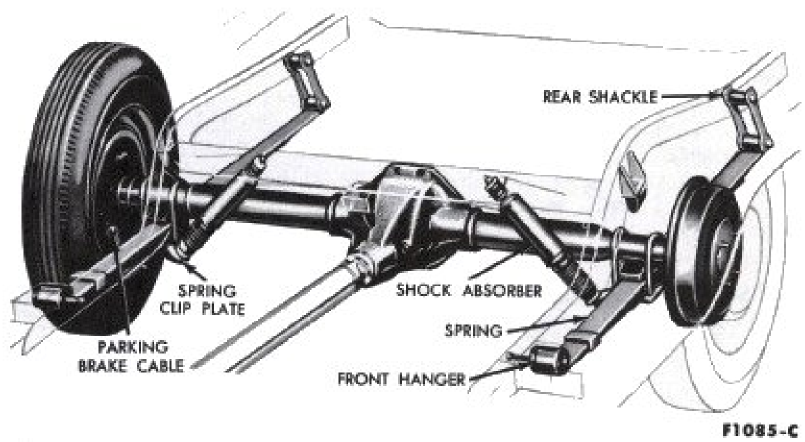


FIG. 2—Rear Suspension

to a bracket in the underbody. The lower end is mounted to the spring pad at the axle housing.

The springs and shock absorbers provide for up and down movement of the rear axle and wheels as required by changes in the road surface. They also cushion road shocks.

2 IN-CAR ADJUSTMENTS AND REPAIRS

FRONT SUSPENSION

UPPER BALL JOINT REPLACEMENT—ARM IN CAR

1. Position a support between the upper arm and frame side rail as shown in Fig. 3, then raise the car and position safety stands.

2. Remove the wheel and tire.

3. Using a large chisel, cut off the three upper ball joint retaining rivets.

4. Remove the cotter pin and nut from the upper ball joint stud.

5. Position the ball joint remover tool as shown in Fig. 4. **The tool should seat firmly against the ends of both studs, and not against the lower stud nut.** It may be necessary to remove the lower ball joint cotter pin if it prevents the tool from seating on the lower stud.

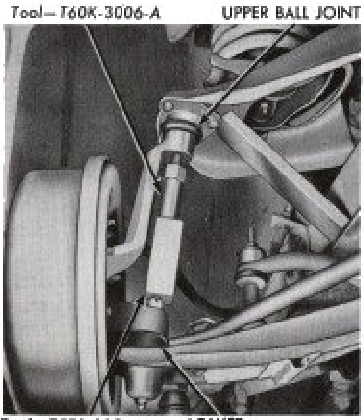


FIG. 4—Locking Upper Ball Joint Stud in Spindle

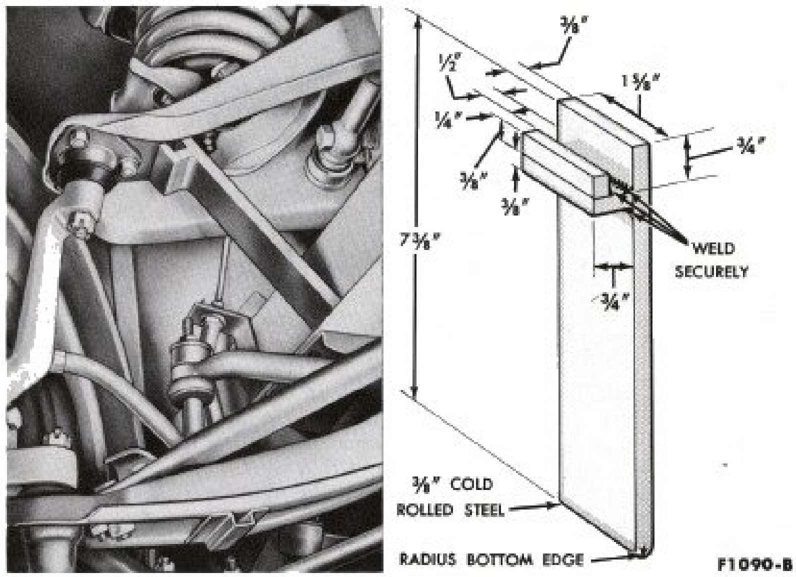


FIG. 3—Upper Arm Support

6. Turn the tool with a wrench until both studs are under tension, and then, with a hammer, tap the spindle near the upper stud to loosen the stud from the spindle. **Do not loosen the stud with tool pressure alone.** Remove the ball joint.

7. Clean the end of the arm, and remove all burrs from the hole edges. Check for cracks in the metal at the holes, and replace the arm if it is cracked.

8. Attach the new ball point to the upper arm. **Use only the specified bolts, nuts, and washers. Do not rivet the new ball joint to the arm.** Torque the nuts to specification.

9. Position the ball joint stud in the spindle bore, and torque the retaining nut to specification. Install a new cotter pin, tighten the nut if necessary to line up the cotter pin hole.

10. Lubricate the ball joint, and install the wheel and tire.

11. Remove the safety stands, and lower the car.

12. Remove the support from between the upper arm and frame.

13. Check and, if necessary, adjust caster, camber, and toe-in.

3 REMOVAL AND INSTALLATION

FRONT SUSPENSION

FRONT SPRING REPLACEMENT

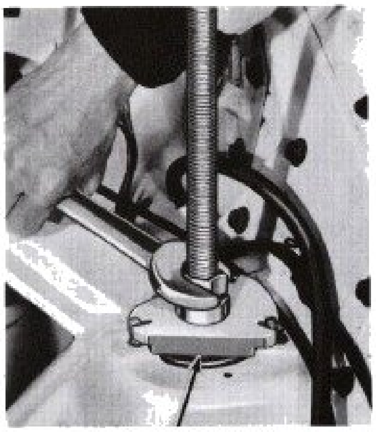
Removal

1. Position a support between the upper arm and frame as shown in Fig. 3.

2. Raise the car and remove the wheel and tire as an assembly.

3. Remove the shock absorber lower retaining nuts.

4. Remove the shock absorber upper mounting bracket retaining bolts and remove the bracket and shock absorber (Fig. 7).



Tool—T63P-5310-A and Adapter T64K-5310-A F1087-B

FIG. 5—Removing Coil Spring

5. Install a safety stand at the front end of the underbody.

6. Install the tool shown (Fig. 5) through the top of the spring housing so that the tool lower studs fit into the shock absorber lower mounting holes, and secure the tool to the spring seat with two nuts.

7. Fit the tool pilot into the spring upper seat, then compress the spring by tightening the nut on the threaded shaft of the tool. Tighten the nut until the spring is loose in its housing.

8. Remove the spring lower seat attaching nuts, then lift the assembly to disengage the spring seat from the suspension arm.

9. Guide the spring and tool down and out the forward end of the wheelhousing.

Installation

1. If the spring is to be replaced, measure the spring height compressed in the tool. Place the tool nut in a vise and rotate the assembly by hand until the spring is decompressed (Fig. 6).

2. Transfer the tool to the new spring. Be sure that the pilot of the tool fits into the spring upper seat and that the spring coil is firmly seated in **both** grooves of the spring lower seat.

3. Place the tool nut in a vise, and rotate the spring until the previously measured spring height is attained.

4. Lift the spring and tool into place and position the assembly so that the spring seat groove containing the lower end of the spring coil is to the outboard side.

5. Install the spring lower seat to suspension arm retaining nuts.

6. Loosen the spring removal tool nut until the spring is properly seated, and then remove the tool (Fig. 5).

7. Install the shock absorber.

8. Install the wheel and tire assembly, remove the safety stand, and lower the car.

9. Remove the support from between the upper arm and frame.

UPPER ARM REPLACEMENT

Removal

1. Remove the front spring as outlined under "Removal" in the foregoing procedure.

2. Position a safety stand under the lower arm.

3. Remove the cotter pin from the nut on the upper ball joint stud, and loosen the nut one or two turns. **Do not remove the nut from the stud at this time.**

4. Position the ball joint remover tool, and install the tool shown in Fig. 4 between the upper and lower ball joint studs. **The tool should seat firmly against the ends of both studs and not against the stud nuts.**

5. Turn the tool with a wrench until the tool places the studs under tension, and then tap the spindle near the upper stud with a hammer to loosen the stud in the spindle. **Do not loosen the stud in the spindle with tool pressure only.** If both arms are being removed, loosen the lower stud in the same manner as the upper stud.

6. Remove the nut from the upper stud and lift the stud out of the spindle.

7. Remove the upper arm inner shaft retaining nuts from the engine compartment, and remove the upper arm. Measure and note the total shim thickness at each inner shaft bolt.

8. Wipe off all loose dirt from the upper arm parts. **Do not wash the ball joint with a solvent.**

Installation

1. Position the upper arm on the underbody mounting bracket, and install but do not tighten the nuts and lockwashers on the two inner shaft retaining bolts. **The specified keystone-type lockwashers must be used.**

F1089-B

FIG. 6—Spring Replacement

2. Install the adjusting shims on both bolts between the inner shaft and the underbody. **Install the same shim thicknesses that were removed from both bolts during disassembly.** Torque the nuts to specification.

3. Position the upper ball joint stud in the top of the wheel spindle, and install the stud nut. Torque the nut to specification, and continue to tighten it until the cotter pin hole and slots line up. Install a new cotter pin.

4. Lubricate the upper ball joint.

5. Position the support between the upper arm and frame and install the coil spring. Follow steps 4 through 9 under "Installation" in the foregoing procedure.

6. **Check and, if necessary, adjust caster, camber, and toe-in.**

LOWER ARM REPLACEMENT

Removal

1. Position the tool shown in Fig. 3 under the upper arm for support.

2. Raise the car, position safety stands, and remove the wheel and tire.

3. Remove the stabilizer bar and link retaining nut, disconnect the bar from the link, and remove the link bolt.

4. Remove the strut to lower arm retaining nuts and bolts, and remove

the steering arm stop.

5. Remove the cotter pin from the nut on the lower ball joint stud, and loosen the nut one or two turns. **Do not remove the nut from the stud at this time.**

6. Straighten the cotter pin on the upper ball joint stud nut. Position ball joint remover tool between the upper and lower ball joint studs in the reverse position from that shown in Fig. 4. **The tool should seat firmly against the ends of both studs and not against the stud nuts.**

7. Turn the tool with a wrench until the tool places the studs under tension, and tap the spindle near the lower stud with a hammer to loosen the stud in the spindle. **Do not loosen the stud in the spindle with tool pressure only.** If both arms are being removed, loosen the upper stud in the same manner as the lower stud.

8. Remove the nut from the lower ball joint stud, and lower the arm.

9. Remove the lower arm to underbody pivot bolt, nut and washer. Remove the lower arm.

Installation

1. Position the lower arm to the underbody and install the pivot bolt, washer, and nut. Torque to specification.

2. Install the stabilizer link bolt, washers, bushings and spacer. Connect the stabilizer bar to the link. Install the retaining nut and torque to specification (Fig. 1).

3. Using a floor jack, raise the lower suspension arm, and guide the lower ball joint stud into the spindle. Install the stud nut and torque to specification.

4. Position the strut and steering arm stop to the lower control arm. The stop goes between the arm and strut. Install the retaining bolts and nuts and torque to specification.

5. The distance from the back face of the strut rear insulator washer to the center of the strut-to-lower arm front retaining bolt should be 16$\frac{9}{16}$ inches (Fig. 1). Check and, if necessary, correct by turning the strut adjusting nuts.

6. Install the lower ball joint retaining nut cotter pin, and bend the upper ball joint retaining nut cotter pin.

7. Lubricate the lower ball joint. **Do not lubricate the lower arm bushings.**

8. Install the wheel and tire, remove the safety stands, and lower the car. Remove the tool supporting the upper arm.

9. **Check and, if necessary, adjust caster, camber, and toe-in.**

FRONT WHEEL SPINDLE REPLACEMENT

Removal

1. Position a support between the upper arm and frame as shown in Fig. 3, then raise the car and position safety stands.

2. Remove the hub cap or wheel cover, and back off the brake shoe adjusting screw.

3. Remove the grease cap from the hub, then remove the adjusting nut, washer, and outer bearing cone and roller assembly.

4. Pull the wheel, hub, and drum assembly off the wheel spindle.

5. Remove the brake carrier plate from the spindle. Support the plate to prevent damage to the brake hose.

6. Disconnect the spindle connecting rod end from the spindle arm using Tool OTC-462.

7. Remove the cotter pins from both ball joint stud nuts, and loosen the nuts one or two turns. **Do not remove the nuts from the studs at this time.**

8. Position the ball joint remover tool between the upper and lower ball joint studs (Fig. 4). **The tool should seat firmly against the ends of both studs and not against the stud nuts.**

9. Turn the tool with a wrench until the tool places the studs under tension, and, with a hammer, tap the spindle near the studs to loosen them in the spindle. **Do not loosen the studs in the spindle with tool pressure alone.**

10. Remove the stud nuts and the spindle from both studs, using a floor jack under the lower suspension arm.

Installation

1. Position the spindle on the lower ball joint stud and install the stud nut.

2. Using a floor jack raise the lower supension arm, and guide the upper ball joint stud into the spindle. Install the stud nut.

3. Torque the upper stud nut then the lower stud nut to specification. Continue to tighten both nuts until the cotter pin holes and slots line up. Install new cotter pins.

FIG. 7—Removing Front Shock Absorbers

4. Connect the spindle connecting rod end to the spindle arm.

5. Install the brake carrier plate on the spindle, and torque the bolts to specification.

6. Install the wheel and drum, adjust the wheel bearing (Part 3-5) and adjust the brakes (Group 2).

7. Remove the safety stands, and lower the car.

8. Remove the support from between the upper arm and frame.

9. **Check and, if necessary adjust caster, camber, and toe-in.**

SHOCK ABSORBERS

Passenger cars and station wagons are equipped with hydraulic shock absorbers of the direct-acting type and are nonadjustable and nonrefillable, and cannot be repaired.

Before replacing a shock absorber, check the action of the shock absorbers by grasping the bumper and jouncing the car up and down. If the shock absorbers are in good condition the car will immediately settle to a normal position after the bumper is released.

Testing

To check a shock absorber removed from a car proceed as follows:

1. Hold the shock absorber in the vertical position with the piston

(lower end) up, and pull out the piston rod until the shock is extended to its full length.

2. With the shock absorber held in the same position, push in the piston rod until the shock is compressed to its shortest length.

3. Repeat steps 1 and 2 several times until all the air is expelled.

4. Clamp the lower end (small diameter) in a vise in a vertical position.

5. Extend the shock to its full length and then compress it to its shortest length. There should be a constant drag during the complete cycle. Any sudden loss of drag indicates air in the system or faulty internal valve operation. Replace defective shock absorbers.

Front Shock Absorber Removal

1. Raise the front end of the car and place supports under both suspension lower arms. **Be sure that the lower end of the shock absorber remains accessible for servicing.**

2. Disconnect the shock absorber lower retaining nuts from the spring lower seat.

3. Remove the shock absorber upper mounting bracket retaining nuts. Lift the bracket and shock absorber from the car (Fig. 7).

4. Remove the shock absorber from the mounting bracket.

5. Remove the bushing and washers from the shock absorber stud.

Front Shock Absorber Installation

1. Assemble the bushings to the shock absorber lower attaching studs.

2. Install the washer and upper bushing to the shock absorber. Install the upper mounting bracket, bushing, washer and retaining nut to the shock absorber.

3. Extend the shock absorber and install to the spring lower seat. Install the lower bushings, washers, and torque the nuts to specification.

4. Install the upper mounting bracket to the body. Torque the retaining nuts to specification.

5. Torque the shock absorber to mounting bracket nut to specification.

STABILIZER REPLACEMENT

Removal

1. Raise the car high enough to provide working space, and place supports under both front wheels.

2. Disconnect the stabilizer from each link. Disconnect both stabilizer retaining brackets, and remove the stabilizer.

Installation

1. Coat the necessary parts of the stabilizer with RUGLYDE or a comparable lubricant, and slide new insulators onto the stabilizer.

2. Connect the stabilizer retaining brackets, and connect the stabilizer to both links. Torque the bracket retaining screws and the link bolt nut to specification.

3. Remove the supports and lower the car.

LOWER ARM STRUT AND/OR BUSHING REPLACEMENT

Removal

1. Position the tool shown in Fig. 3 under the upper arm for support.

2. Raise the car, position safety stands, and remove the wheel and tire.

3. Remove the strut - to - bracket forward retaining nut, washer and insulator bushing.

4. Remove the two strut-to-lower arm retaining nuts and bolts, remove the steering arm stop, then lift the strut with rear insulator bushing, washer from the car (Fig. 1).

Installation

1. Install the rear nut, washer, and insulator bushing to the strut.

2. Position the strut into the mounting bracket and to the lower suspension arm. Position the steering arm stop between the strut and the arm, install the strut-to-arm retaining bolts and nuts, and torque to specification.

3. Install the outer insulator bushing, washer, and nut to the forward end of the strut, and torque the strut rod nuts to specification.

4. Install the wheel and tire, remove the safety stands and lower the car. Remove the tool supporting the upper arm.

REAR SUSPENSION

REAR SPRING REPLACEMENT

Removal

1. Raise the car on a hoist and place supports beneath the underbody and under the axle.

2. Disconnect the lower end of the shock absorber from the spring clip plate, and push the shock out of the way.

3. Remove the spring clip plate nuts from the U-bolts, then remove the plate (Fig. 11).

4. Remove the two retaining nuts, the rear shackle bar, and the two shackle inner bushings.

5. Remove the rear shackle assembly and the two outer bushings.

6. Remove the front hanger bolt, washer, and inner rubber bushing from the eye at the forward end of the spring, then lift out the spring assembly. Remove the outer bushing from the eye of spring.

Installation

1. Install the outer bushing in the eye at the forward end of the spring. **The forward end is the shorter end of the spring between the center tie bolt and the spring eye.** Install the two outer bushings in the rear shackle assembly.

2. Position the spring under the rear axle and insert the shackle assembly into the rear hanger bracket and the rear eye of the spring.

3. Install the shackle inner bushings, the shackle plate, and the locknuts. Tighten the locknuts finger tight.

4. Position the spring forward eye to the front hanger, and insert the front hanger stud through the eye and hanger. Tighten the stud finger tight.

5. Torque the rear shackle locknuts to specification.

6. Lower the rear axle until it rests on the spring. Position the spring clip

FIG. 8—Rear Shock Absorber Access Cover

plate on the clips (U-bolts). Install the U-bolt nuts and torque to specification.

7. Connect the lower end of the shock absorber to the spring clip plate.

8. Place safety stands under the rear axle, lower the car until the spring is in the approximate curb load position, and then torque the front hanger stud locknut to specification.

9. Remove the safety stands and lower the car.

REAR SHOCK ABSORBER REMOVAL

1. Disconnect the shock absorber from the spring clip plate (Fig. 10).

2. On the passenger car, remove the shock absorber access cover from the luggage compartment (Fig. 8).

On the Ranchero, remove the retaining screws, and lift the forward half of the floor panel from the body; then remove the access cover from the opening in the floor pan over the shock absorber.

On station wagons, remove the access cover from the opening in the seat riser over the shock absorber.

3. Remove the shock absorber upper retaining nut.

4. Compress the shock absorber and remove it from the car. Remove the bushings and washers from the shock absorber studs.

REAR SHOCK ABSORBER INSTALLATION

1. Place the bushings and washers on the shock absorber studs.

2. Connect the upper stud to the bracket, and install the bushing, washer, and nut on the stud. Torque the nut to specification, and install the cover (on a station wagon or car).

On the Ranchero, after installing the access cover in the floor pan, install the forward half of the floor panel.

3. Connect the lower stud to the spring clip plate, and install the bushing, washer, and nut on the stud. **Be sure the spring clip plate is free of burrs.** Tighten the nut to specification.

REAR SUSPENSION ALIGNMENT CHECK

Suspected misalignment or "dog tracking of front and rear wheel treads should be checked. Drive the car straight ahead on a section of pavement, part of which is wet, and stop about ten feet beyond the wet area. If alignment is correct, the rear tire imprints will appear an equal distance slightly outside the front tire tracks (Fig. 9). It is permissible to have a variation of ¾ inch width in the tire imprints.

TIE BOLT OFF-CENTER

Misalignment may result from a rear spring tie bolt head which is not centered in the locating hole of the spring mounting pad on the axle housing (Fig. 10). To determine whether or not this bolt is off-center, measure the distance A (Fig. 11). Dimension A should be the same, within ⅛ inch, on both sides of the car.

To center the tie bolt in the axle pad seat or lower spring clip plate take the following steps:

1. Loosen the four spring clip nuts.

2. With a jack, push or pull the housing into position.

3. While there is jack pressure, move the spring clip into line with the new position of the housing.

4. Torque the spring clip nuts to specifications.

5. Recheck the distance between front and rear tire imprints, and adjust further if necessary.

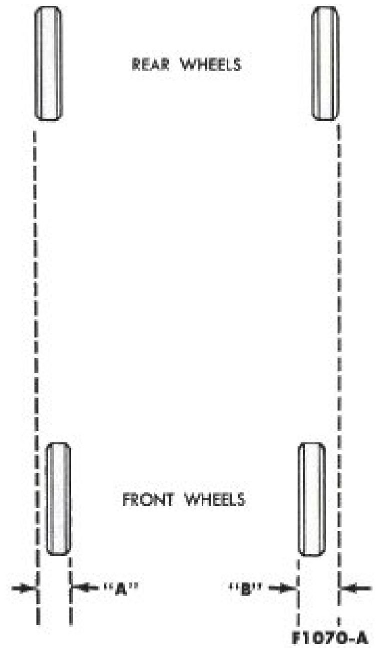


FIG. 9—Suspension Alignment Check

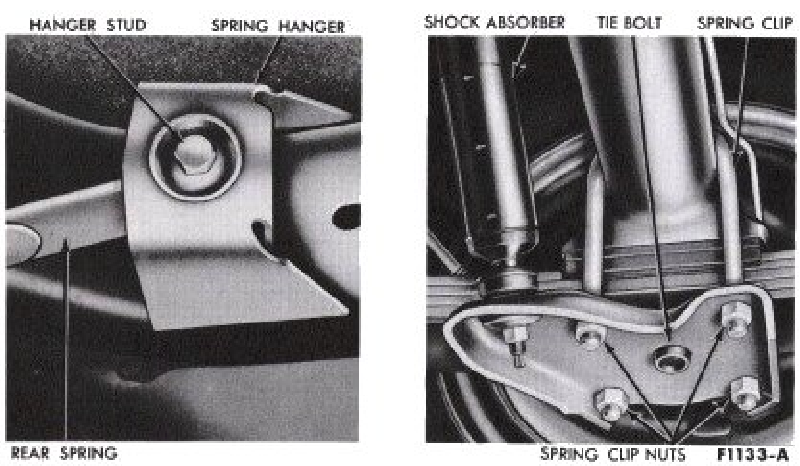


FIG. 10—Rear Spring and Spring Clips—Typical

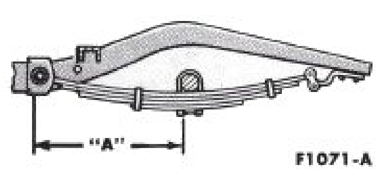


FIG. 11—Rear Spring Hanger Alignment Check

PART 3-3 MANUAL STEERING

1 DESCRIPTION

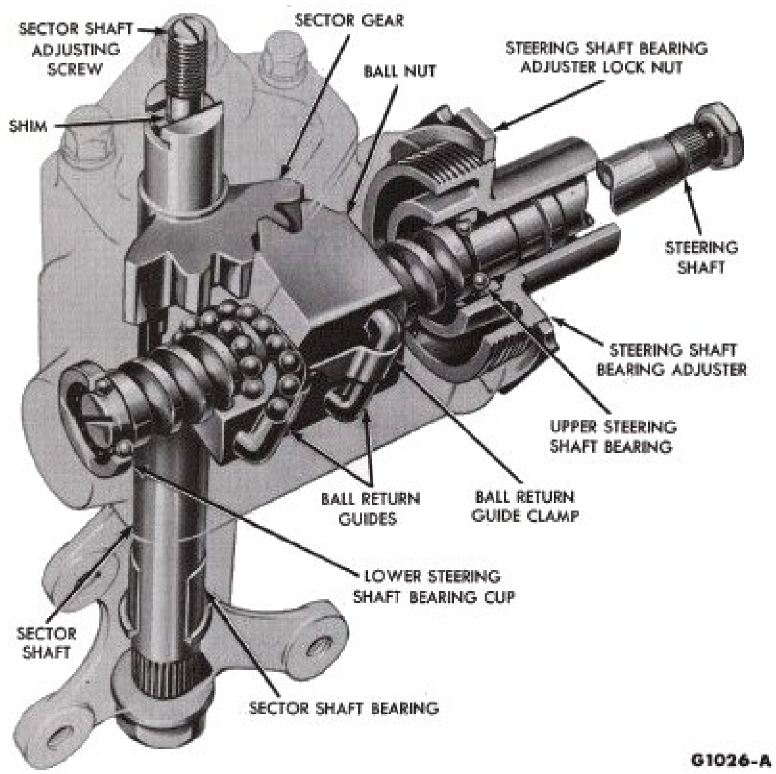


FIG. 1—Recirculating Ball Type Steering Gear

The steering gear (Fig. 1) is of the worm and recirculating ball type. The sector shaft rotates in needle bearings that are pressed into the gear housing.

The worm bearing preload is controlled by the large bearing adjuster which is threaded into the housing. The sector shaft mesh load is controlled by an adjusting screw located in the housing cover.

A steering gear identification tag is provided under one of the cover attaching bolts (Fig. 2).

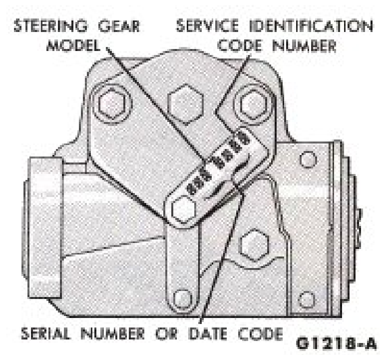


FIG. 2—Steering Gear Identification Tag

2 IN-CAR ADJUSTMENTS AND REPAIRS

STEERING WORM AND SECTOR GEAR ADJUSTMENTS

The ball nut assembly and the sector gear must be adjusted properly to maintain minimum steering shaft end play (a factor of preload adjustment) and minimum backlash between sector gear and ball nut. There are only two possible adjustments within the recirculating ball-type steering gear, and **these should be made in the following order to avoid damage or gear failure.**

1. Disconnect the Pitman arm from the sector shaft.

2. Remove the steering wheel, spring and the centering cone from the shaft and note the relation of the shaft to the bearing.

3. If the shaft is not centered, attach a spring scale to it.

4. Center the shaft by pulling on the scale and note the reading.

5. If more than 20 lbs. pull is required to center the shaft, the steering column should be aligned as detailed in steering gear installation, before adjusting the preload and mesh load.

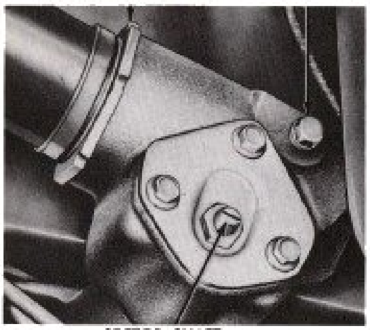


FIG. 3—Steering Gear Adjustments

6. Loosen the nut which locks the sector adjusting screw (Fig. 3), and turn the adjusting screw counterclockwise.

7. Measure the worm bearing preload by attaching an inch-pound torque wrench to the steering wheel nut (Fig. 4). With the steering wheel off center, read the pull required to rotate the input shaft approximately 1½ turns either side of center. If the torque or preload is not within specification (Part 3-6), adjust as explained in the next step.

8. Loosen the steering shaft bearing adjuster lock nut, and tighten or back off the bearing adjuster (Fig. 3) to bring the preload within the specified limits.

9. Tighten the steering shaft bearing adjuster lock nut, and recheck the preload.

10. Turn the steering wheel slowly to either stop. **Turn gently against the stop to avoid possible damage to the ball return guides.** Then rotate the wheel 2¼ turns to center the ball nut.

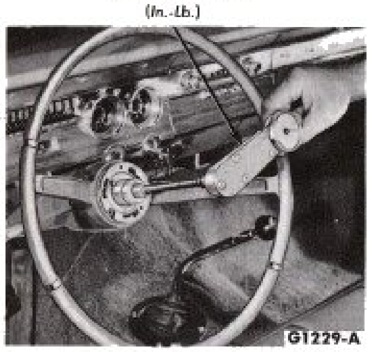


FIG. 4—Checking Preload

11. Turn the sector adjusting screw clockwise until the specified pull (Part 3-6) is necessary to rotate the worm past its center high spot (Fig. 4). **No perceptible backlash is permissible at 30° on either side of center.**

12. While holding the sector adjusting screw, tighten the locknut to specification and recheck the backlash adjustment.

13. Connect the Pitman arm to the sector shaft.

STEERING WHEEL SPOKE POSITION ADJUSTMENT

When the steering gear is on the high point, the front wheels should be in the straight-ahead position and the steering wheel spokes should be in their normal position with the Pitman arm pointing directly forward. If the spokes are not in their normal position, they can be adjusted without disturbing the toe-in adjustment (Part 3-1).

STEERING WHEEL REPLACEMENT

1. Remove the horn ring (or button) assembly and related parts.
2. Remove the steering wheel attaching nut and remove the steering wheel from the shaft, using the tool shown in (Fig. 5).
3. With the front wheels straight forward, position the steering wheel on the steering shaft with the spokes properly centered and the splines on both parts properly aligned.
4. Install the steering wheel nut on the shaft. Torque the nut to specification, and stake it in place.
5. Install the horn ring (or button) assembly and the related parts.

STEERING COLUMN SHIFT TUBE REPLACEMENT

REMOVAL

1. Remove the steering wheel, spring and centering sleeve.
2. Remove the turn indicator lever. Place the gear shift selector lever in the neutral position and remove the lever.
3. Loosen the flange retaining nuts until pressure on the nuts (toward the column center) will disengage the bolt heads. Lift the flange from the column and drape the flange and the signal wires over the top of the column.
4. Remove the gear shift lever socket from the steering column tube.
5. Remove the shift tube.

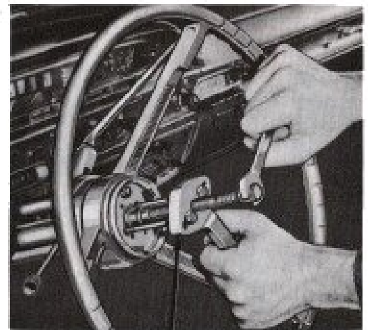


FIG. 5—Removing Steering Wheel—Typical

INSTALLATION

1. After applying Lubriplate to the lower area of the shift tube, position the shift tube in the steering column tube. The shift tube is seated when spring pressure can be felt.
2. Install the gear shift lever socket, being careful not to damage the wiring insulation as the socket is positioned.
3. Install the flange and tighten the retaining nuts.
4. Install the turn signal lever and the selector lever.
5. Install the centering sleeve, spring and steering wheel.

STEERING COLUMN UPPER BEARING REPLACEMENT

1. Disconnect the horn wire and the turn indicator wires at the connectors. Remove the horn ring (or button) and the spring.
2. Remove the steering wheel attaching nut. Remove the steering wheel (Fig. 5) with a puller. Lift the spring and the centering sleeve from the shaft.
3. Remove the turn indicator lever. Remove the upper bearing retainer screws and move the turn signal switch to one side.
4. Remove the steering column upper bearing from the flange.
5. After applying Lubriplate, install the new upper bearing.
6. Position the upper bearing retainer and the signal switch and install the three retainer screws.
7. Install the turn indicator lever and position the centering sleeve and the spring. After applying Lubriplate to the horn switch brush plate, install the steering wheel.
8. Connect the turn indicator and horn wires and test their operation.

3 REMOVAL AND INSTALLATION

FIG. 6—Removing Pitman Arm

STEERING GEAR REMOVAL AND INSTALLATION

REMOVAL

1. Raise the front of the car onto safety stands. Remove the Pitman arm from the sector shaft (Fig. 6).

2. Remove the steering gear attaching bolts and disconnect the transmission shift rod(s) at the gear shift lever(s).

3. Pull the rubber seal up on the steering column, fold the floor mat aside, and move the dash panel insulation out of the way.

4. Remove the retaining screws from the steering column weather seal on the dash panel. Remove the steering column cover plates and gasket.

5. Disconnect the horn and turn indicator wires under the instrument panel. Also on a car with an automatic transmission, disconnect the neutral switch wires.

6. Remove the horn ring (or button). Remove the steering wheel retaining nut and the steering wheel (Fig. 5).

7. Remove the upper bearing centering sleeve and spring.

8. Remove the steering column clamp to instrument panel bolts and remove the clamp (upper and lower halves) and the insulator.

9. Slide the steering column tube assembly from the steering gear shaft, guiding the shift lever(s) up through rubber seal at the dash panel.

10. Remove the steering gear.

    a. On a car equipped with a 6-cylinder engine, lift the steering gear out through the engine compartment being careful not to soil or tear the front seat fabric.

    b. On a car equipped with an 8-cylinder engine, disconnect the wires from the spark plugs on the left side of the engine and place them to one side.

11. Remove the master cylinder attaching bolts and remove the lower brake line to dash panel attaching clip. Move the master cylinder upward toward the cross-brace taking care not to kink the brake tubes.

12. Remove the No. 7 cylinder rear exhaust upper manifold attaching bolt.

13. Lift the steering gear and shaft assembly from the engine compartment by raising the gear up and forward past the engine and spring taking care not to soil or tear the front seat fabric.

INSTALLATION

1. Install the steering gear.

    a. On a car equipped with a 6-cylinder engine, guide the shaft through the dash panel being careful not to soil or tear the front seat fabric. Install but, do not tighten the steering gear attaching bolts.

    b. On a car equipped with an 8-cylinder engine, guide the shaft through the dash panel being careful not to soil or tear the front seat fabric. Install, but do not tighten the steering gear attaching bolts.

Position the master cylinder and install and torque the bolts to specification. Position the brake tube lower and install the attaching clip.

Connect the left bank of spark plug wires. Install the manifold attaching bolt that was previously removed.

2. Slide the steering column tube assembly over the steering shaft, guiding the shifting arms through the rubber seal at the dash panel.

3. Position the steering column assembly and retaining clamp and insulator, and loosely install the attaching bolts and nuts.

4. Tighten the steering gear to side rail mounting bolts and column to instrument panel retaining bracket.

5. After tightening the steering gear to side rail mounting bolts and column to instrument panel retaining bracket, check the steering shaft to column upper bearing clearance. If the shaft does not touch the bearing, no further re-adjustment is required. If the shaft is touching the column upper bearing, it will be necessary to check the pull required to center the shaft in the column, using a fish scale. Where pull exceeds 20 lbs. at either plane to center the shaft in the column, the following correction must be made:

Vertical movement of the steering shaft can be accomplished by loosening the steering gear mounting bolts and pivoting the gear up and down.

Horizontal movement of the steering shaft can be accomplished by loosening the steering column to instrument panel retaining bracket and moving the column to the left or right.

Should additional horizontal movement be required to align the steering shaft, it will be necessary to insert shim(s) of proper thickness between the steering gear assembly and the vehicle side rail. Front end alignment shims can be used for this purpose. After the steering shaft is centered, torque all bolts to specification.

6. Position the upper bearing centering sleeve and spring. After applying Lubriplate to the upper surface of the steering shaft upper bearing and the horn switch brush plate, position the steering wheel. Install and stake the retaining nut. Install the turn indicator lever.

7. Install the horn ring (or button) and spring, and steering wheel to the center point.

8. Position the sector shaft arm, and torque the attaching nut to specification.

9. Lower the car from the safety stands. Connect the horn, turn indicator wires, and (on a car with an automatic transmission) the neutral switch wires.

10. Connect the transmission shift rod(s). Position the steering column cover plates and gasket on the dash panel and install the retaining screws.

11. Position the dash panel insulation just above the steering column. Position the floor mat and push the rubber seal down to the floor mat.

12. If necessary, correct adjustment of the shift lever(s) and the neutral switch.

4 MAJOR REPAIR OPERATIONS

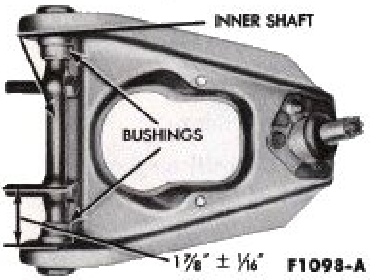


FIG. 7—Installing Inner Arm and Bushing

UPPER ARM OVERHAUL—ARM REMOVED

BUSHING AND INNER SHAFT REPLACEMENT

Always replace both upper arm bushings if either bushing is worn or damaged. Install only new bushings when replacing the inner shaft.

1. Unscrew the bushings from the inner shaft and suspension arm, then remove the shaft from the arm.

2. Position the shaft in the arm. Lubriplate and install the new bushings on the shaft and the arm. **Turn the bushings so that the shaft is exactly centered in the arm.** The shaft will be properly centered when located at the dimension shown in Fig. 7. **Position the bushings carefully to avoid damaging the O-rings inside the bushings.**

3. Torque the bushings to specification.

UPPER BALL JOINT REPLACEMENT

The upper ball joints can be replaced with the upper arm in the car. If replacement is required refer to Section 2 "In-Car Adjustment and Repairs".

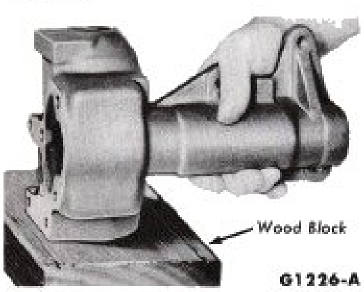


FIG. 8—Removing Lower Bearing Cup from Housing

STEERING GEAR

DISASSEMBLY

1. Rotate the steering shaft approximately 2¼ turns from either stop.

2. After removing the sector adjusting screw locknut and the housing cover bolts, remove the sector shaft with the cover. Remove the cover from the shaft by turning the screw clockwise. **Keep the shim with the screw.**

3. Loosen the worm bearing adjuster nut, and remove the adjuster assembly and the steering shaft upper bearing and cup.

4. Carefully pull the steering shaft and ball nut from the housing. **To avoid possible damage to the ball return guides, keep the ball nut from running down to either end of the worm.**

Disassemble the ball nut only if there is indication of binding or tightness.

5. Remove the lower bearing and cup from the housing. It may be necessary to tap the housing on a block of wood (Fig. 8) to loosen it from the housing.

6. Remove the ball return guide clamp and the ball return guides from the ball nut. **Keep the ball nut clampside up until ready to remove the balls.**

7. Turn the ball nut over, and rotate the worm shaft from side to side until all 62 balls have dropped out of the nut into a clean pan. With the balls removed, the ball nut will slide off the worm.

Press both sector shaft bearings out of the housing (Fig. 9). **Remove the seal and the bearings only if there is an indication of wear or damage, or bearing mislocation. Do not install a new bearing in a housing in which the bearing has turned or found to be mislocated. A new housing must be used.**

STEERING GEAR

ASSEMBLY

1. If the sector shaft bearings have been removed, press new bearings into the housing (Fig. 10).

2. Position a bearing cup in the adjuster.

3. If the sector shaft oil seal has been removed, install a new oil seal.

4. Swab the inside diameter of the ball nut and the outside diameter of the worm with gear lubricant ESW-

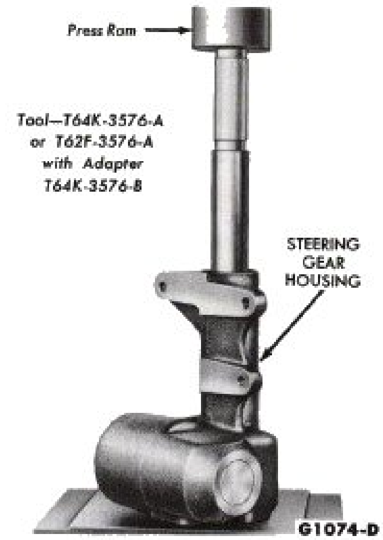


FIG. 9—Removing Sector Shaft Bearing

M-1687-A prior to assembly. Lay the steering shaft on a bench as shown in Fig. 11. After positioning the shaft, turn the ball nut to place the guide holes in the up position. Align the grooves in the worm and in the ball nut by sighting through the ball guide holes.

5. Count 31 balls, and drop as many of them as possible into one of the guide holes, slowly turning the worm away from the holes, until that circuit is full or until rotation is

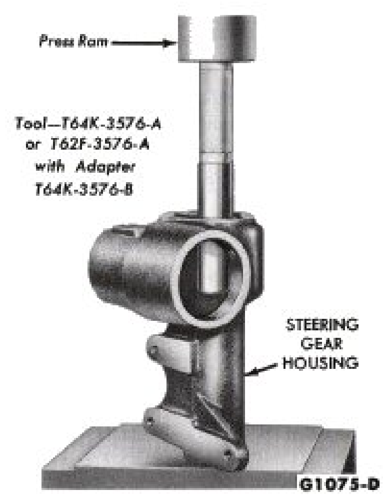


FIG. 10—Installing Sector Shaft Bearing

stopped by the end of the worm. If the balls are stopped by the end of the worm, hold in those already positioned, and turn the worm in the opposite direction. The filling of the circuit can then be continued until most of the balls are in place.

6. Lay one half of the ball return guide on the bench, and place the remainder of the 31 balls in it. Position the second half of the guide and, holding the two halves together, plug each open end with gear lubricant so the balls will stay in the guide when it is installed.

7. Push the guide into the guide holes of the ball nut, tapping lightly with the wooden handle of a screw driver if necessary.

8. Assemble the second ball return circuit in the same way as the first.

9. Install the ball return guide clamp and screws. Check the ball nut to see that it rotates freely. Torque the screw to specification.

10. Coat the threads of the steering shaft bearing adjuster, the housing cover bolts, and the sector adjusting screw with a suitable oil-resistant sealing compound. **Do not apply sealer to female threads, and especially avoid getting any sealer on the steering shaft bearings.**

11. Coat the worm bearings, sector shaft bearing and gear teeth with gear lubricant ESW-M1687-A.

12. Clamp the housing in a vise, with the sector shaft axis horizontal, and position the steering shaft lower bearing cup and the bearing in place.

13. Position the steering shaft and ball nut assembly in the housing.

14. Position the steering shaft upper bearing on the top of the worm, and install the steering shaft bearing adjuster and cup. Install the lock nut with the flat side against the bearing adjuster and the letter "S" outward. Leave the nut loose.

15. After installing the steering wheel nut on the steering shaft, adjust the worm bearing preload, using an inch-pound torque wrench to check for specified preload.

16. Position the sector adjusting screw and the adjuster shim, and check the end clearance which should not exceed 0.002 inch between the screw head and the end of the sector shaft. If clearance is greater than 0.002 inch, replace the shim.

17. Thread the sector shaft adjusting screw into the housing cover.

18. Install a new gasket on the housing cover.

19. Rotate the steering shaft until the ball nut teeth are in position to mesh with the sector gear, tilting the housing so that the ball nut will tip

FIG. 11—Positioning Ball Nut—Typical

toward the housing cover opening.

20. Apply enough gear lubricant ESW-M1687-A to fill the pocket in the housing between the sector shaft bearings 30% full.

21. Push the housing cover with the sector shaft into place.

22. Turn the cover to one side and fill the housing with ½ lb. of gear lubricant ESW-M1687-A.

23. **Install but do not tighten the housing cover attaching bolts. Do not tighten the cover bolts until it is certain that there is some lash between the ball nut and the sector gear teeth.**

24. After loosely installing the sector shaft adjusting screw lock nut, adjust the sector shaft mesh to the specified mesh load, then tighten the adjusting screw lock nut. Remove the steering wheel nut.

5 STEERING LINKAGE REPAIR

The manual steering linkage (Fig. 12) consists of the Pitman arm, the steering arm-to-idler arm rod, the steering idler arm, and the spindle connecting rods (tie rods). **Do not attempt to straighten bent linkage; use new parts.**

SPINDLE CONNECTING ROD END REPLACEMENT

The spindle connecting rod ends, which are threaded into the outer ends of the rod sleeves, have non-adjustable, spring-loaded ball studs. A rod end should be replaced when excessive looseness at the ball stud is noticed.

1. Remove the cotter pin and nut from the worn rod end ball stud (Fig. 12).

2. Disconnect the end from the spindle, connecting arm, Pitman arm, or idler arm as shown in Fig. 13.

3. Loosen the connecting rod sleeve clamp bolts, and count the number of turns needed to remove the rod end from the sleeve. Discard all rod end parts that were removed from the sleeve. **All new parts should be used when a spindle connecting rod end is replaced.**

4. Thread a new rod end into the sleeve, but do not tighten the sleeve clamp bolts at this time.

5. Install the seal on the rod end ball stud, insert the stud in the part from which the old one was removed, and install the stud nut. Torque the nut to specification and install the cotter pin.

6. Check and, if necessary, adjust toe-in (Part 3-1). **After toe-in is checked and adjusted, torque the old sleeve clamp bolts to specification. Add four pounds torque if new bolts are used.**

SPINDLE SLEEVE REPLACEMENT

A spindle sleeve should be replaced if it becomes worn or damaged (Fig. 12). **Do not attempt to straighten the sleeve if threaded portion is damaged.**

1. Remove the spindle connecting rod ends as described in the previous sub-section.

2. Screw the spindle rod ends into the new sleeve the same number of turns as the ends that were removed. Do not tighten the clamp bolts at this time.

3. After installing the seal on the rod ends, position the sleeve assembly on the Pitman arm (or the idler arm) and the spindle arm. Install the attaching nut, torque it to specification, and install the cotter pin.

4. Check and, if necessary, adjust toe-in (Part 3-1). After toe-in is checked and adjusted, torque the sleeve clamp bolts to specification.

STEERING ARM-TO-IDLER ARM ROD REPLACEMENT

The rod connecting the Pitman arm and the idler arm is non-adjustable and has non-adjustable ball studs on all 6-cylinder car steering linkage. On the 8-cylinder car linkage, the rod connecting the Pitman

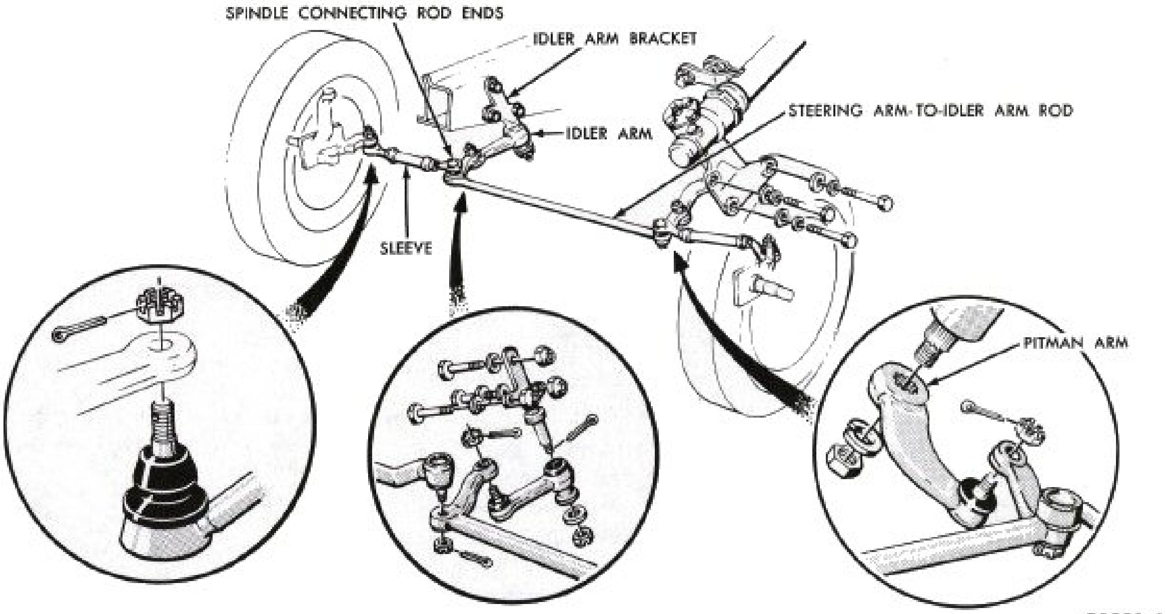


FIG. 12—Typical Steering Linkage 8 Cylinder Shown

arm and the idler arm is provided with tapered holes to accommodate the ball studs (Fig. 12). The rod should be replaced when damaged (all) or when worn at the ball studs (6 cylinder only).

1. Remove the cotter pins and nuts from the ball studs at the sector shaft arm and the idler arm, and remove the steering arm-to-idler arm rod (Fig. 13).
2. After installing new seals on the ball studs, position the new steering arm-to-idler arm rod on the idler arm and the steering arm.
3. Install the ball stud retaining nuts and torque to specification.
4. Install cotter pins, lubricate the power steering ball stud socket if necessary.
5. Check and, if necessary, adjust toe-in (Part 3-1).

STEERING IDLER ARM BUSHING REPLACEMENT

On six-cylinder cars the idler arm used to service the Comet models includes the bushing; therefore it is only necessary to replace the complete arm when worn. Use the following procedure to replace the Falcon idler arm bushing:

To replace the bushing, use the tool shown in Fig. 14. After replacing the bushing and connecting the linkage, check and, if necessary, adjust the toe-in.

On eight-cylinder cars with manual steering it will be necessary to replace the idler arm if the bushing or ball joint is worn or damaged.

To replace the idler arm, remove the cotter pin and nut that secures the steering arm-to-idler arm rod. Disconnect the rod from the idler arm as shown in Fig. 13. Remove the cotter pin, nut and the washer that secures the idler arm to the idler arm bracket. Remove the idler arm from the bracket.

Position the new idler arm on the idler arm bracket and secure it with a washer and slotted nut. Secure the rod to the idler arm with a slotted nut. Torque the slotted nuts to specifications and install the cotter pins.

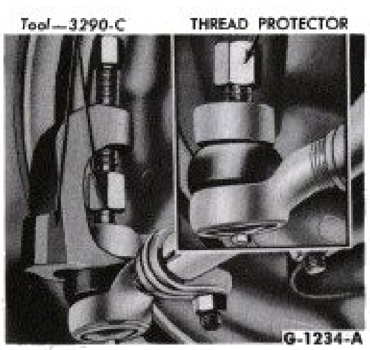


FIG. 13—Disconnecting Spindle End

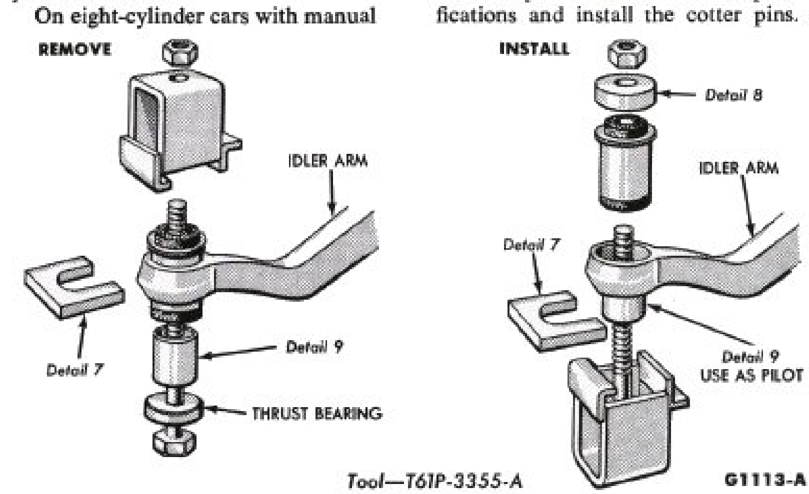


FIG. 14—Replacing Idler Arm Bushing

PART 3-4 POWER STEERING

1 DESCRIPTION

Master-Guide Power Steering (Fig. 1) is a hydraulically controlled linkage-type steering system which includes a fluid reservoir and pump, a control valve, a power cylinder, the connecting fluid lines, and the steering linkage. The roll-type hydraulic pump, belt-driven from the engine crankshaft, draws fluid from the reservoir and provides fluid pressure for the system. Within the pump itself is a pressure-relief valve which governs the pressures within the steering system according to the varying conditions of operation. After fluid has passed from the pump to the control valve and the power cylinder, it returns to the reservoir.

The control valve, operated by steering wheel movement, directs the pressure developed by the pump. When the front wheels are in the straight-ahead position, the control valve spool is held in the center (neutral) position by its centering spring. Fluid then flows around the valve lands and returns to the reservoir (Fig. 2). Within the control valve body there is a reaction limiting valve which reduces parking effort.

When force of about 4 pounds is exerted for a left turn, the valve spool overcomes the pressure of the centering spring and moves toward the right end of the valve. As a result, pressure is exerted on the right side of the power cylinder piston, and fluid in the left end of the cylinder returns to the reservoir (Fig. 2).

If the direction of the force on the steering wheel is reversed, the front wheels will return to the straight forward position. Or as force on the steering wheel falls below approximately 4 pounds the valve spool centering spring forces the spool back to the center position and there the pressure on both sides of the power cylinder piston is equal. With normal forward driving movement of the car and in the absence of operative pressure within the power cylinder, the front wheels will seek to return to the straight ahead position. This is a normal effect of the front wheel alignment.

For a right turn, the directional forces explained above are reversed (Fig. 2).

If, for any reason, the pump fails to deliver fluid pressure, the car may be steered without pump pressure. An engine idle speed control device (Fig. 3) eliminates the problem of the engine stalling when the driver parks the car. When the steering spindle arm stops are contacted, the output of the pump becomes maximum and the maximum pressure is directed to the control valve.

The maximum pressure causes the plunger of the control valve to move the bellcrank linkage; thus, the proper engine idle speed is maintained. Refer to the engine specification section of this manual for the proper engine idle speeds.

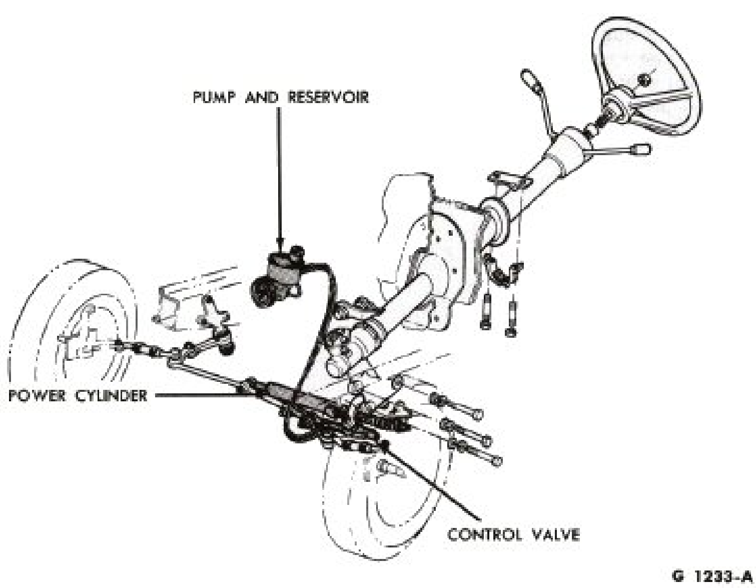


FIG. 1—Power Steering System

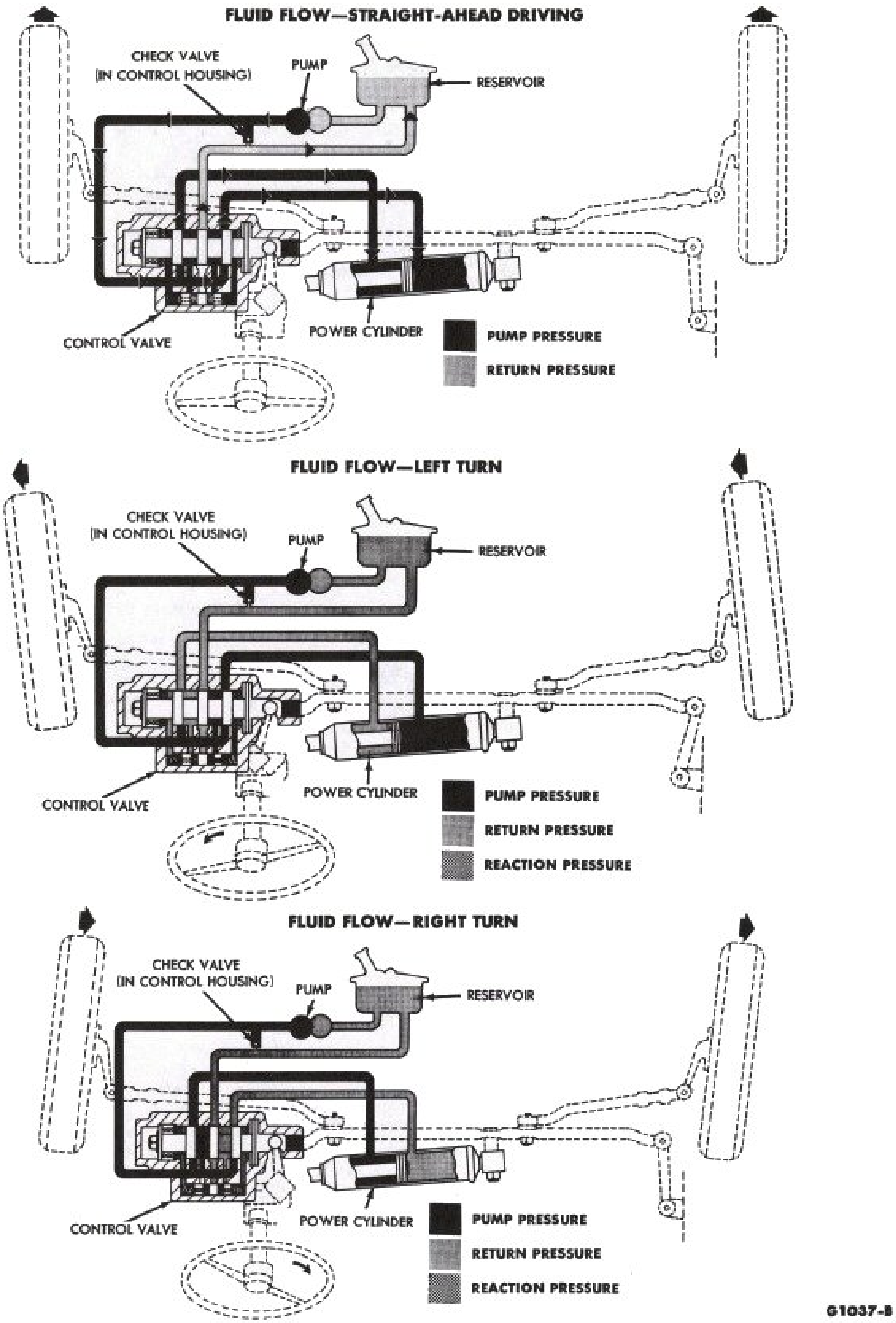


FIG. 2—Fluid Flow Diagram

2 IN-CAR ADJUSTMENTS AND REPAIRS

PUMP BELT TENSION ADJUSTMENT

Pump drive belt tension cannot be checked accurately using the thumb pressure or belt deflection methods. Correct belt adjustment is assured only with the use of a belt tension gauge.

1. Check the belt tension with a gauge. With a new belt, or one that has been run for less than 15 minutes, the tension should be within 120-150 lbs. With a belt that has been run for more than 15 minutes, the tension should be within 90-120 lbs.

2. To adjust the belt, loosen the pump pivot and adjusting bolts to allow movement of the bracket in its adjusting slot. Move the pump as required, and snugly tighten the bolts. **Do not move the pump by lifting or pulling on the reservoir.**

3. Recheck the belt tension. When the tension has been correctly adjusted, tighten the bolts to 22-28 ft-lbs torque.

FILTER REPLACEMENT

1. Remove the cover from the power steering pump or reservoir and remove the gasket. Clean the gasket surface.

2. Remove the fluid with a suction gun.

3. Lift the hold-down spring, washer and the filter element from the reservoir.

4. Wipe the reservoir clean with a lint-free cloth.

5. Position a new filter unit on the seat (Fig. 4).

6. Cement (M2G14-A) a new cover gasket around the inside of the cover.

7. Position the retaining washer and the hold-down spring on the filter element.

8. Install the cover and gasket. On units equipped with remote mounted reservoir, turn the wing nut down until it is flush with the top of the stud.

9. Fill the reservoir and check for leaks.

10. Recheck the fluid level and replenish the fluid as required.

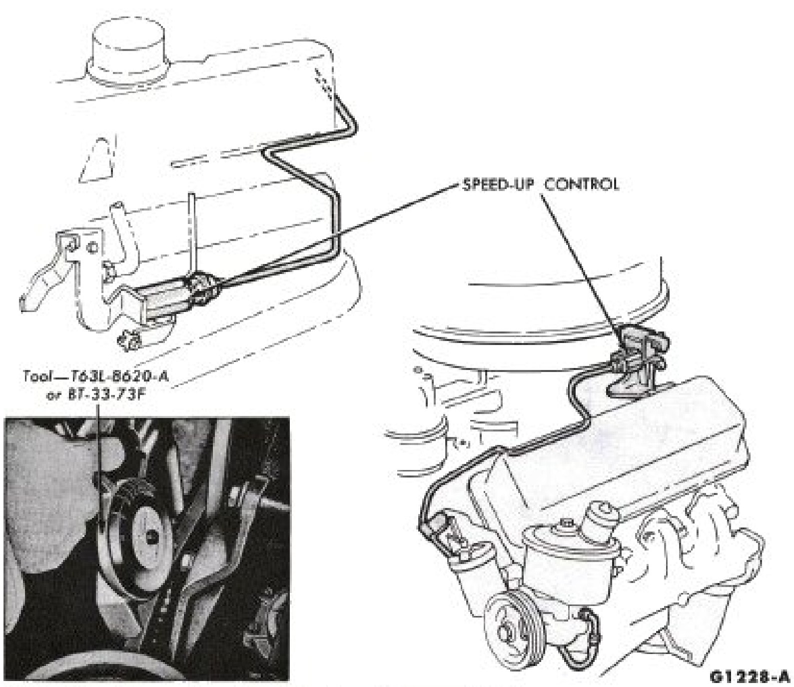


FIG. 3—Power Steering Idle Speed Control Valve

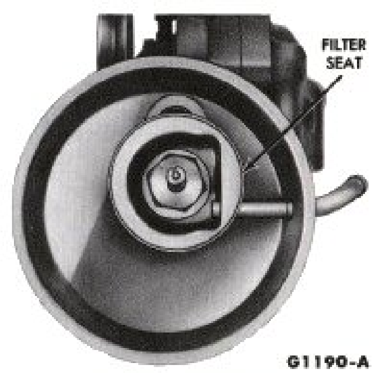


FIG. 4—Fluid Reservoir

3 REMOVAL AND INSTALLATION

STEERING GEAR

Refer to Part 3-3, Section 3, for detailed instructions.

POWER STEERING PUMP

REMOVAL

1. Remove the fill cap from the reservoir and remove the fluid with a suction gun.

2. Disconnect the fluid return hose from the reservoir.

3. Disconnect the oil pressure line from the pump.

4. Disconnect the idle speed-up valve line from the pump.

5. Loosen the belt adjusting bolt and the pivot bolt. Remove the drive belt from the pump pulley.

6. Remove the power steering pump-to-bracket attaching bolts, then lift the pump from the engine.

INSTALLATION

1. Secure the power steering pump to the bracket with the attaching bolts, but do not tighten the bolts at this time.

2. Position the drive belt on the power steering pump pulley and on the crankshaft pulley.

3. With Tool T63L-8620-A installed on the pump drive belt, raise the pump to obtain the specified belt tension, then tighten the adjusting bolt.

4. Tighten all of the pump attaching bolts at this time.

5. Connect the oil pressure line and the idle speed-up line to the pump.

6. Connect the oil return line to the reservoir.

7. Fill the pump reservoir to the correct level. Start the engine and turn the steering wheel to each end of its travel several times to cycle the system. Check the fluid level and fill as required. Install the fill cap.

8. Start the engine and check for leaks.

POWER STEERING CONTROL VALVE

REMOVAL

1. Disconnect the pressure lines leading from the power cylinder to the control valve, at the valve. Allow the lines to drain into a container.

2. Disconnect the lines leading from the power steering pump to the control valve at the valve. Allow the lines to drain into a container. Remove the clamp that secures the lines to the valve.

3. Remove the two bolts that secure the control valve to the steering arm-to-idler arm rod.

4. Remove the cotter pin and the castellated nut that secures the control valve to the Pitman arm.

5. Disconnect the control valve from the Pitman arm as shown in Fig. 5.

6. Inspect the tube fittings and the seats in the valve for nicks, burrs or damage. Replace the seats in the valve or the tubes as required.

INSTALLATION

1. Place the stud in a straight vertical position. Measure from the center of the stud parallel to the bolt mounting surface (Fig. 6) to the center of the first bolt hole. The distance should be from $4\frac{1}{4}$"-$4\frac{5}{16}$". If not within these limits adjust the length as required.

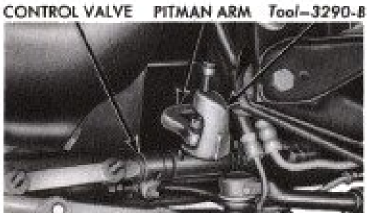


FIG. 5—Disconnecting Control Valve from Pitman Arm

2. Secure the control valve stud to the Pitman arm with the castellated nut and a cotter pin.

3. Secure the end of the control valve to the steering arm-to-idler arm rod with two bolts, lock washers and nuts.

4. Connect the pressure line and the oil return line to their respective fittings on the valve. Install the line retaining clamp around the valve.

5. Connect the two lines from the power cylinder to their respective fittings on the valve.

6. Fill the reservoir to the correct level.

7. Start the engine and turn the steering wheel to each end of its travel several times to cycle the system. Stop the engine.

8. Check the fluid level and fill as necessary. Install the fill cap.

9. Start the engine and check for leaks.

POWER CYLINDER

REMOVAL

1. Disconnect the two fluid lines from the power cylinder and allow them to drain into a container.

2. Remove the pal nut, attaching nut, washer and the insulator from the end of the power cylinder rod.

3. Remove the cotter pin and castellated nut that secures the power cylinder stud to the steering arm-to-idler arm rod.

4. Disconnect the power cylinder stud from the steering arm-to-idler arm rod as shown in Fig. 7.

5. Remove the insulator sleeve and washer from the end of the power cylinder rod.

6. Inspect the tube fittings and the seats in the power cylinder for nicks, burrs or damage. Replace the seats in the cylinder or the tubes as required.

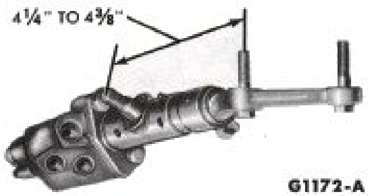


FIG. 6—Control Valve Length Adjustment

INSTALLATION

1. Install the washer, sleeve and the insulator on the end of the power cylinder rod.

2. Extend the rod as far as possible. Insert the rod in the bracket on the frame and compress the rod as necessary to insert the stud in the steering arm-to-idler arm rod. Secure the stud with a castellated nut and a cotter pin.

3. Secure the power cylinder rod with an insulator, washer, nut and a pal nut.

4. Connect each of the two fluid lines to their respective part in the cylinder.

5. Fill the reservoir to the correct level.

6. Start the engine and turn the steering wheel to each end of its travel several times to cycle the system. Stop the engine.

7. Check the fluid level and fill as necessary. Install the fill cap.

8. Start the engine and check for leaks.

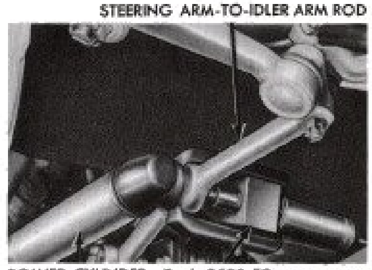


FIG. 7—Disconnecting Power Cylinder Stud

4 MAJOR REPAIR OPERATIONS

POWER STEERING PUMP

DISASSEMBLY

Handle all parts very carefully to avoid nicks, burrs, scratches and dirt which could make the parts unfit for use.

1. Drain as much as possible of the remaining fluid from the pump and reservoir, and clamp the pump adjusting bracket in a vise.

2. On a car without air conditioning, remove the reservoir cover. Remove the reservoir retaining nut and reinforcement from inside the reservoir and lift the reservoir off the pump. On cars equipped with air conditioning, it may be necessary to remove the adapter.

3. Remove the two orifice O-rings from the top of the pump. Pumps with adapters have only one O-ring.

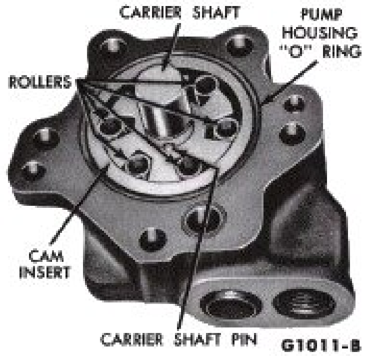


FIG. 8—Roll Type Pump Housing, Carrier & Shaft

4. Remove the pulley and key from the carrier shaft.

5. Remove all the bolts from the pump, and separate the bracket, pump housing, and housing cover. If the parts do not pull apart easily, tap them gently with a soft hammer to loosen them. **Lift the cover vertically from the housing to prevent internal parts from falling out.**

6. Remove the O-rings and the cam insert (Fig. 8).

7. Using a feeler gauge and a straight-edge, check the end clearance of the carrier and the rollers in the pump housing (Fig. 9). If the clearance exceeds 0.0015 inch, replace the worn parts. **A damaged roller, carrier, or insert should not be replaced by itself; these parts are serviced in a kit, and all parts of the kit should be used.**

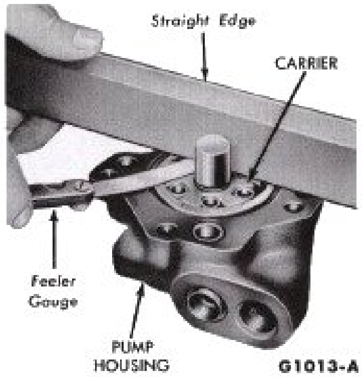


FIG. 9—End Clearance Check

8. Remove the six rollers, and then pull out the carrier and shaft very carefully to avoid damage to these parts or the oil seal. **Remove the cam insert only for replacement.**

9. Slide the carrier off the shaft and remove the carrier shaft pin (Fig. 8).

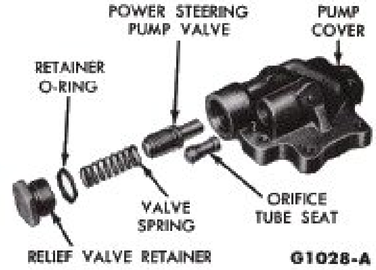


FIG. 10—Pump Cover

10. Remove the relief valve retainer (Fig. 10) from the housing cover, and remove the O-ring from the retainer.

11. Remove the valve spring from the bore in the housing cover, and slide the valve out of the bore. If the valve does not slide out easily, tap the cover with a soft hammer. **Do not scratch or nick the valve when removing it from the cover.**

CONTROL VALVE

DISASSEMBLY

1. Wipe all fluid and loose dirt from the outside of the control valve.

2. Remove the centering spring cap from the valve housing (Fig.

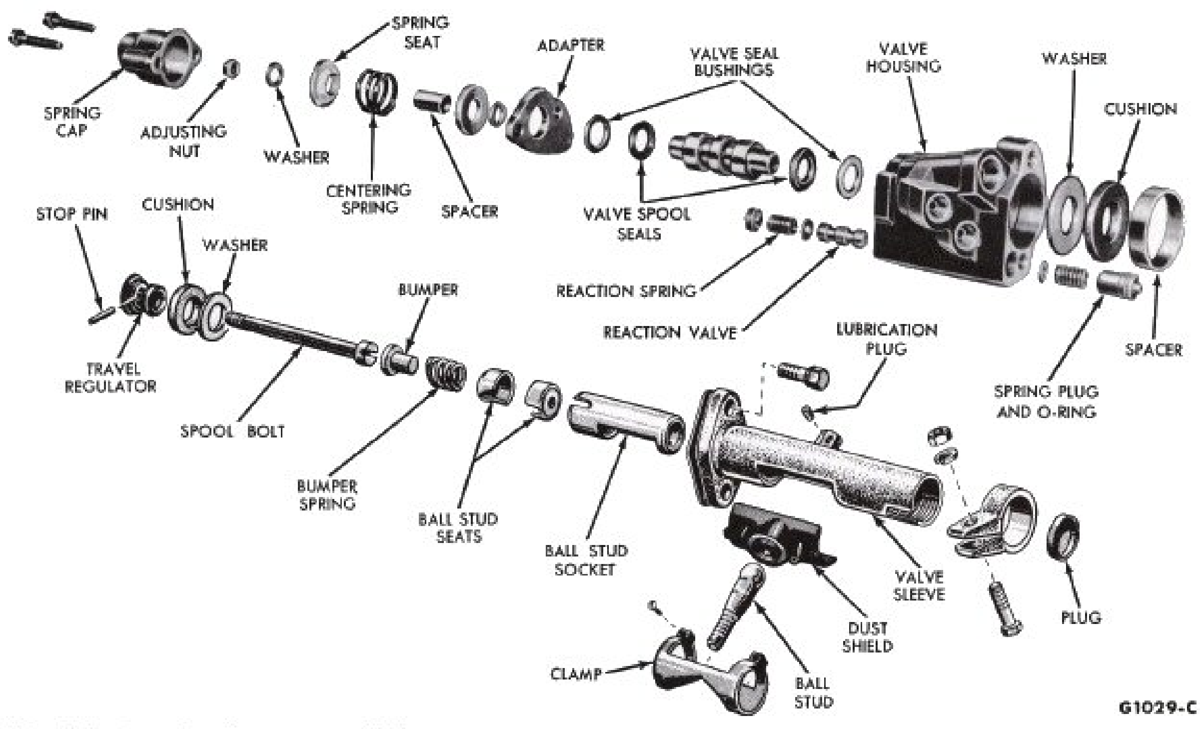


FIG. 11—Control Valve Disassembled

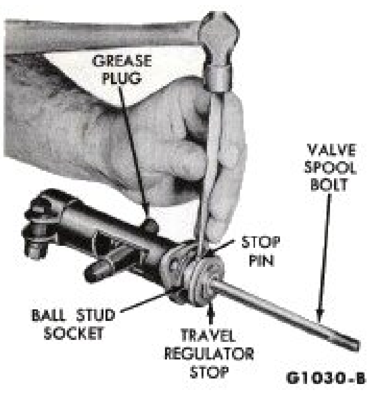


FIG. 12—Removing Stop Pin

11). **When holding the control valve for disassembly, use a soft-jawed vise, and clamp the valve only around the sleeve flange to prevent damage to the housing, spool, or sleeve.**

3. Remove the nut from the end of the valve spool bolt. Remove the washers, spacer, centering spring, adapter, and bushing from the bolt and the valve housing.

4. Remove the two bolts that hold the valve housing and the sleeve together, and separate the housing from the sleeve.

5. Remove the plug from the valve sleeve.

6. Push the valve spool out of the centering spring end of the valve housing, and remove the seal from the spool.

7. Remove the spacer, bushing, and seal from the sleeve end of the valve housing.

8. Drive the stop pin out of the travel regulator stop with a punch and hammer (Fig. 12). **Pull the head of the valve spool bolt tightly against the travel regulator stop before driving the pin out of the stop.**

9. Turn the travel regulator stop counterclockwise in the valve sleeve to remove the stop from the sleeve.

10. Remove the valve spool bolt, spacer, and rubber washer from the travel regulator stop.

11. Remove the rubber boot and clamp from the valve sleeve.

12. Slide the bumper, spring, and ball stud seat out of the valve sleeve, and remove the ball stud socket from the sleeve.

13. After removing the return port hose seat, remove the return port relief valve.

14. After removing the spring plug and O-ring, remove the reaction limiting valve (Fig. 13).

POWER CYLINDER

SEAL REMOVAL

1. Clamp the power cylinder in a vise, and remove the snap ring from the end of the cylinder. **Be careful not to distort or crack the cylinder in the vise.**

2. Pull the piston rod out all the way to remove the scraper, bushing, and seals. If the seals cannot be removed in this manner, remove them from the cylinder with a sharp pick. Take care, when using a pick, not to damage the shaft or seal seat.

PARTS REPAIR AND REPLACEMENT

PUMP

Orifice Tube Seat Replacement. If damage, wear, or leakage makes replacement of this seat necessary, use the following procedure.

1. Tap the existing hole in the seat, using a starting tap of suitable size. **Be sure to remove all metal chips from the seat port after tapping.**

2. Place a nut and large flat washer on a bolt of the same size as the tapped hole. The washer must be large enough to cover the seat port.

3. Insert the bolt in the tapped hole and, using it as a puller remove the seat.

4. Place a new seat in the port, and thread a bolt of suitable size into the port. Tighten the bolt enough to bottom the seat in the port.

Carrier Shaft Seal Replacement. If the carrier seal was removed from the pump housing, install a new seal. **Do not install the old seal.**

1. Coat the lip of a new seal with Lubriplate or an equivalent lubricant.

Position the seal in the bore of the housing. **The lip of the seal must face toward the pump housing carrier chamber.**

3. Press the seal into the housing (Fig. 14) until it seats firmly and evenly against the shoulder in the bore.

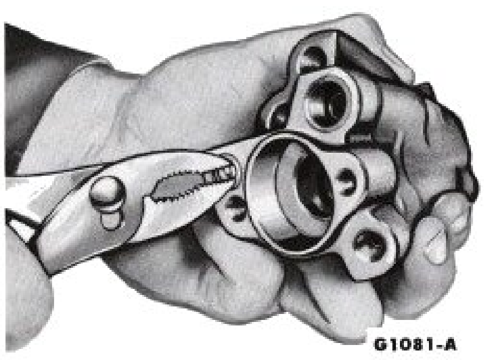


FIG. 13—Removing Reaction Valve Plug

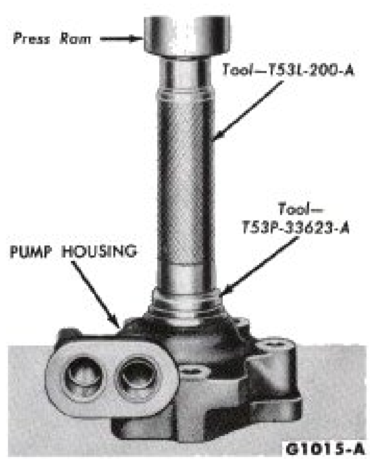


FIG. 14—Carrier Shaft Seal Installation

CONTROL VALVE

TUBE SEAT REPLACEMENT

If a hose seat is worn or damaged, it should be replaced. It can be removed with an Easy-Out tool, or by using a bolt of appropriate size as a puller.

1. Tap the existing hole in the hose seat, using a starting tap of suitable size. **Be sure to remove all metal chips from the hose seat port after tapping.**

2. Place a nut and large flat washer on a bolt of the same size as the tapped hole. The washer must be large enough to cover the hose seat port.

3. Insert the bolt in the tapped hole, and using the nut as a puller, remove the hose seat.

4. Place a new hose seat in the port, and thread a bolt of suitable size into the port. Tighten the bolt enough to bottom the seat in the port.

POWER STEERING PUMP

ASSEMBLY

Before assembling the pump and reservoir, coat all parts with automatic transmission fluid. **If the cam insert is to be replaced, the new insert must be installed so that the slot in the edge of the insert engages the small pin in the pump housing.**

1. If the carrier and related parts seem to be in good condition, install the pin and the carrier on the shaft. Make sure that the carrier teeth are pointed in a counterclockwise direction when the carrier is installed in the housing.

2. Carefully insert the shaft through the housing, taking care not to damage the seal. Install the rollers. **To avoid damage to the seal, be sure the shaft does not move back and forth in the housing.**

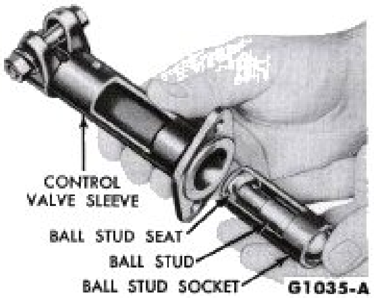


FIG. 15—Installing Ball Stud, Seal & Bracket

3. Position the valve assembly and spring in the bore, install a new O-ring on the pump valve retainer, and install the retainer in the pump housing cover. Torque the retainer to specifications.

4. Place the new O-ring in the groove around the insert in the pump housing, and install a new O-ring in the face of the housing (Fig. 10).

5. Fasten the pump housing and cover together.

6. Clamp the adjusting bracket in a vise, and install the pump on the bracket. Torque all bolts to specifications.

7. Install the key, pulley washer, and retaining bolt on the carrier shaft.

8. Torque the pulley retaining bolt to specification. **The carrier shaft should turn freely when the bolt is properly tightened.**

9. Place the new O-rings in the grooves on the top of the pump housing on pump mounted reservoirs. Only one O-ring is required at the outlet when the adapter is used.

10. Hold the reservoir on the pump housing, and install the reinforcement in the reservoir. Install and torque the retaining bolt to specifications. **The ears on the reinforcement should be facing upward over the outer hole in the reservoir.** On cars equipped with air conditioning, properly position the adapter. Then, install and torque the retaining bolt to specifications.

11. Cement (M2G14-A) a new cover gasket around the inside of the cover. Install only the dipstick-type - cover, washer, and retaining bolt at this time. **The cover must be seated evenly and tightly on the reservoir.**

CONTROL VALVE

ASSEMBLY

Before assembling the control valve, coat all parts except the seals with Ford Automatic Transmission Fluid. Coat the seals with lubricant COAZ-19553-A

1. Install the reaction limiting valve, the spring, and the plug.

2. Install the return port relief valve and the hose seat.

3. Insert one of the ball stud seats (flat end first) into the ball stud

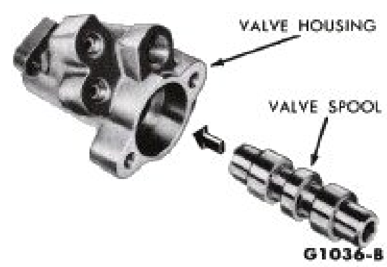


FIG. 16—Inserting Valve Spool

socket, and insert the threaded end of the ball stud into the socket.

4. Place the socket in the control valve sleeve so that the threaded end of the ball stud can be pulled out through the slot in the sleeve (Fig. 15).

5. Place the other ball stud seat, the spring, and the bumper (Fig. 11) in the socket, and install and securely tighten the travel regulator stop.

6. Loosen the stop just enough to align the nearest hole in the stop with slot in the ball stud socket, and install the stop pin in the ball stud socket, travel regulator stop, and valve spool bolt (Fig. 12).

7. Install the rubber boot, clamp, and the plug on the control valve sleeve. **Make sure that the lubrication fitting is turned on tightly and does not bind on the ball stud socket.**

8. Insert the valve spool in the valve housing. **Rotate the spool while inserting it in the housing.**

9. Move the spool toward the centering spring end of the housing, and place the small seal bushing, and spacer in the sleeve end of the housing.

10. Press the valve spool against the inner lip of the seal and, at the same time, guide the lip of the seal over the spool with a small screwdriver. **Do not nick or scratch the seal or the spool during installation.**

11. Place the sleeve end of the housing on a flat surface so that the seal, bushing, and spacer are at the bottom end and push down the valve spool until it stops.

12. Carefully install the spool seal and bushing in the centering spring end of the housing. Press the seal against the end of the spool, guiding the seal over the spool with a small screwdriver. **Do not nick or**

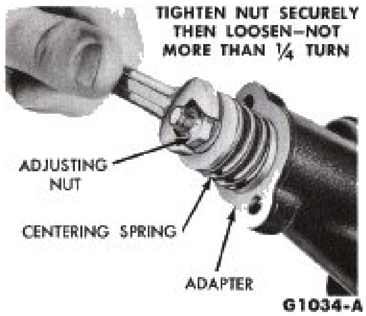


FIG. 17—Adjusting Centering Spring

scratch the seal or the spool during installation.

13. Pick up the housing, and slide the spool back and forth in the housing to check for free movement.

14. Place the valve sleeve on the housing so that the ball stud is on the same side of the housing as the ports for the two power cylinder lines. Install the two bolts in the sleeve, and torque them to specifications.

15. Place the adapter on the centering spring end of the housing, and install the bushing, washers, spacers, and centering spring on the valve spool bolt.

16. Compress the centering spring, and install the nut on the bolt. Tighten the nut snuggly, then, loosen it not more than 1/4 turn (Fig. 17). **Excessive tightening of the nut may break the stop pin at the travel regulator stop.**

17. Move the ball stud back and forth in the sleeve slot to check the spool for free movement. See Part 3-6 for the specified travel. Apply

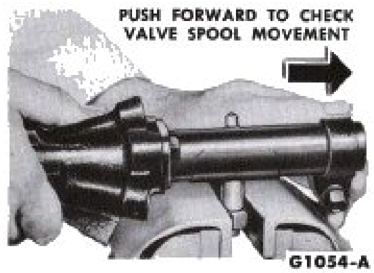


FIG. 18—Inspecting Valve Spool Movement

COAZ-19553-A (silicone) grease at the sealing areas.

18. Install the centering spring cap on the valve housing, and torque the two cap bolts to specification.

19. Install the nut on the ball stud so that the valve can be positioned in a vise as shown in Fig. 18. Then push forward on the cap end of the valve to check the valve spool for free movement.

20. Turn the valve around in the vise, and push forward on the sleeve end to check the spool for free movement.

POWER CYLINDER

ASSEMBLY

When replacing the power cylinder seals, install all of the parts supplied in the repair kit for the cylinder being repaired.

1. Coat the new seals with lubricant COAZ-19553-A and place the parts (Fig. 19) on the piston rod which has been coated with the same grease.

2. Push the rod in all the way, and install the parts in the cylinder with a deep socket slightly smaller than the cylinder opening (Fig. 20).

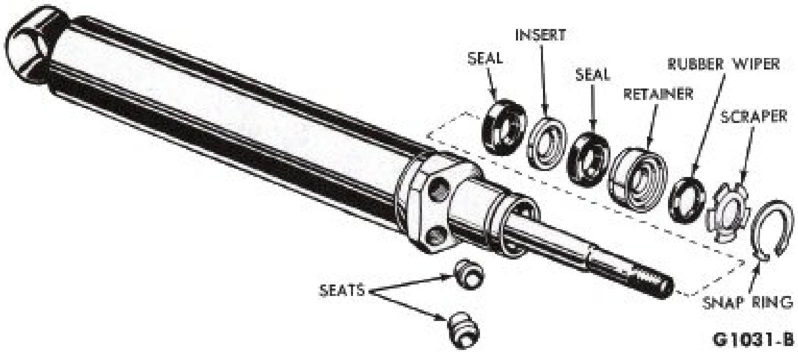


FIG. 19—Power Cylinder

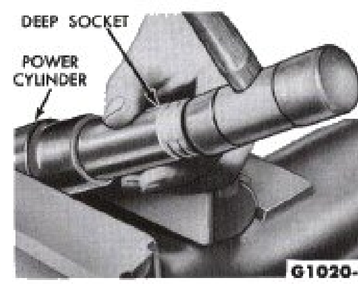


FIG. 20—Installing Power Cylinder Seals

PART 3-5 WHEELS AND TIRES

1 DESCRIPTION AND OPERATION

FRONT WHEEL

Each front wheel and tire assembly is bolted to its respective front hub and brake drum assembly. Two opposed tapered roller bearings are installed in each hub. A grease retainer is installed at the inner end of the hub to prevent lubricant from leaking into the drum. The entire assembly is retained to its spindle by the adjusting nut, nut lock and cotter pin (Fig. 1).

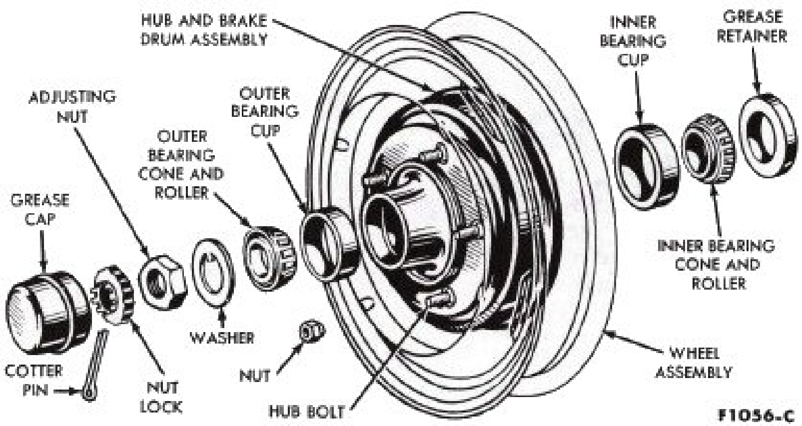


FIG. 1—Front Hub, Bearings and Grease Retainer

REAR WHEEL

The rear brake drum assembly is retained to studs on the rear axle shaft flange by three speed nuts. The wheel and tire assembly mounts on the same rear axle shaft flange studs and is held against the hub and drum by the wheel nuts. The rear wheel bearing is pressed onto the axle shaft just inside the shaft flange, and the entire assembly is retained to the rear axle housing by the bearing retainer plate which is bolted to the housing flange.

The inner end of each axle shaft is splined to the differential in the rear axle.

2 IN-CAR ADJUSTMENT AND REPAIR

FRONT WHEEL BEARING ADJUSTMENT

The front wheel bearings should be adjusted if the wheel is too loose on the spindle or if the wheel does not rotate freely. The following procedure will bring the bearing adjustment to specification.

1. Raise the car until the wheel and tire clear the floor.
2. Pry off the hub cap or wheel cover and remove the grease cap (Fig. 1) from the hub.
3. Wipe the excess grease from the end of the spindle, and remove the cotter pin and nut lock.
4. While rotating the wheel, hub, and drum assembly, torque the adjusting nut to 15-20 ft-lbs to seat the bearings (Fig. 2).
5. Locate the nut lock on the adjusting nut so that the castellations on the lock are aligned with the cotter pin hole in the spindle.
6. Back off both the adjusting nut and the nut lock together until the next castellation on the nut lock aligns with the cotter pin hole in the spindle.

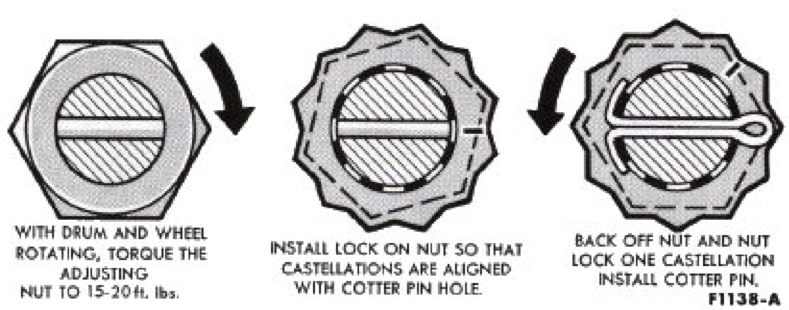


FIG. 2—Front Wheel Bearing Adjustment

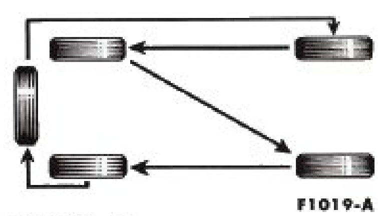


FIG. 3—Tire Cross-Switching Diagram

7. Install a new cotter pin, and bend the ends of the cotter pin around the castellated flange of the nut lock.

8. Check the front wheel rotation. If the wheel rotates properly, install the grease cap and the hub cap or wheel cover. If the wheel still rotates roughly or noisily, clean or replace the bearings and cups as required.

TIRE ROTATION

For longer tire life, all five tires should be cross-switched as shown in Fig. 3. See Group 19 for the specified interval.

PART 3-6 SPECIFICATIONS

CHECKS AND ADJUSTMENTS—STEERING

Sector Shaft End Play Check (Steering Linkage Disconnected)	Minimum End Play	
*Worm Bearing Preload Check	Manual	4-5 in-lbs
	Power	2-4 in-lbs
†Total Preload (Mesh Load plus Worm Bearing Preload)	Manual	9-10 in-lbs
	#Power	5-9 in-lbs
Permissible Backlash at 30° on Either Side of Straight Ahead Steering Wheel Position	No Perceptible Backlash	
Gear Ratio	Manual	19.9:1
	Power	
Steering Wheel Turns (Stop to Stop)	Manual	4⅝
	Power	
Maximum Pull Required to Turn Wheel at Least One Complete Turn Either Direction (Engine Idling)	Power	4½ lbs
Normal Fluid Pressure Against Either Stop (Engine Idling)	Power	750-900 psi
Control Valve Spool Travel (from Center)	Power	0.060 in Approx.
Power Steering Belt Tension Using Tool T63L-8620-A	Power	New: 120-150 lbs
		Used: 90-120 lbs

*Torque required to rotate input shaft at approximately 1½ turns either side of center.
†Required to rotate input shaft and worm assembly past center high point.
#Total preload must be a minimum of 2 in-lbs greater than bearing preload.

TORQUE SPECIFICATIONS—MANUAL STEERING

PART NAME	Ft-Lbs 6 Cyl.	Ft-Lbs 8 Cyl.
Pitman Arm to Idler Arm Rod Nut	25-35	35-47
Spindle Con. Rod to Steering Idler Arm Rod Nut	25-35	35-47
Steering Spindle Con. Rod End to Spindle Arm	25-35	35-47
Steering Spindle Con. Rod Sleeve Clamp Nut	10-15*	19-26
Mesh Load Adjusting Screw Lock Nut	32-40	32-40
Ball Return Guide Clamp Screw	3½-5	3½-5
Adjuster Lock Nut	60-80	60-80
Steering Wheel Attaching Nut	20-30	20-30
Sector Shaft Cover Bolts	20-30	20-30
Pitman Arm Attaching Nut	85-110	150-225
Steering Gear Assembly to Underbody Bolt	45-60	45-60
Steering Column Bracket to Instrument Panel Bolt	12-16	12-16

*Used Nut: 6-10 Ft-Lbs

TORQUE SPECIFICATIONS—POWER STEERING

PART NAME	Ft-Lbs
Power Cylinder to Pitman Arm to Idler Arm Rod	35-47
Spindle Connecting Rod Adjusting Sleeve Nut	19-26
Spindle Arm Connecting Rod to Spindle Arm Nut	25-35†
Hydraulic Control Valve Clamp Nut	15-20
Cylinder Mounting Bracket to Frame Nuts	35-43
Hydraulic Cylinder Piston to Bracket Nut	18-24
Pressure Hose Fitting to Pump	18-25
Pressure Hose Fitting to Control Valve	6-9
Pitman Arm Attaching Nut	85-110
Hose Insulator Brackets to Underbody Bolt	12-15
Pump Valve Retainer	40-75
Pitman Arm to Control Valve Stud	35-47
Spring Cap to Valve Housing Bolts	4-6½
Pump Attaching Bracket to Engine ⅜-16 5/16-18 ¼-20	 23-28 12-15 8-10
Return Hose Fitting to Valve	10-20
Valve to Cylinder Hose Fittings	14-18

†8-Cylinder—35-47

CASTER*

Degrees	$+\frac{1}{2}° \pm \frac{1}{2}°$
Difference between shim stack thicknesses at two bolts should not exceed	$\frac{1}{32}$ inch
$\frac{1}{32}$" change in shim thickness at either bolt will change caster angle	$\frac{1}{2}°$

*Maximum difference between both front wheel caster angles $\frac{1}{2}°$ ($\frac{1}{4}°$ preferred).

TREAD AND TOE-IN

Tread (Inches)	Front		6-Cyl.-55 8-Cyl.-55.6
	Rear		56
Toe-In (Inches)			$\frac{1}{4}$—$\frac{5}{16}$
Toe-Out on Turns (Degrees)†	6 Cyl.	Std./Str.	$19\frac{5}{8}°$
		Pwr./Str.	$20\frac{1}{8}°$
	8 Cyl.	Std./Str.	$18\frac{7}{8}°$
		Pwr./Str.	$18\frac{7}{8}°$

†Angle of outside wheel when inside wheel is turned 20°.

TORQUE LIMITS—FRONT SUSPENSION

Description	Ft-Lbs
Lower Arm Ball Joint Assembly to Spindle Slotted Nut	35-65
Upper Arm Ball Joint Assembly to Spindle Slotted Nut	35-65
Bumper Assembly—Suspension Compression to Body Bracket Stud Nut	12-17
Arm and Inner Shaft Assembly—Upper Suspension to Body Bolt	65-90
Lower Arm Assembly to Underbody Lock Nut	60-75
Lower Arm Strut to Underbody Lock Nut	40-55
Shock Absorber Assembly to Spring Seat Bolt	12-17
Shock Absorber to Upper Mounting Bracket Stud Nut	15-25
Brake Assembly to Front Spindle Lock Nut	25-35
Front Stabilizer to Lower Arm Stud Nut	12-17
Front Strut to Lower Arm Bolt	40-55
Shock Absorber Upper Bracket to Body Nut	8-13
Front Stabilizer to Body Lock Nut	11-16
Upper Arm Shaft to Upper Arm Bolt	40-55
Shaft—Upper Arm Spring Seat to Upper Arm Lock Nut	13-18
Lower Arm Ball Joint Preload	20-30*
Wheel Nut Torque Limits	55-85
Upper Ball Joint to Suspension Arm	12-15

*Inch-Pounds

CAMBER*

Degrees	$+\frac{1}{2}° \pm \frac{1}{2}°$
Maximum shim stack thickness at each bolt	$\frac{1}{16}$ inch
$\frac{1}{16}$" change in shim thickness at both bolts will change camber angle	$\frac{1}{2}°$

*Maximum difference between both front wheel camber angles $\frac{1}{2}°$ ($\frac{1}{4}°$ preferred).

TORQUE LIMITS—REAR SUSPENSION

Description	Ft-Lbs
Spring Assembly to Rear Spring Front Hanger Lock Nut	30-40
Spring Shackle Bars to Body Lock Nut	13-20
Spring Shackle Bar to Rear Spring Assembly Lock Nut	13-20
Spring Assembly to Rear Axle "U" Bolt Lock Nut	13-20
Universal Joint Flange—Axle End to Bearing Ass'y Nut	9-10
Rear Shock Absorber to Upper Mounting Bracket Stud Nut	15-25
Rear Shock Absorber to Spring Clip	15-25
Hanger Bracket to Underbody Nut	20-27

FALCON REAR SPRING ASSEMBLY—USAGE CHART

Model Usage	Engine Usage	No. Leafs
Sedans & Hardtops 62A, B, C 63 B, C 54A, B	 6 & 8 Cylinder 6 Cylinder 6 & 8 Cylinder	3
Convertible & Hardtop 63A, B 76A, B	 8 Cylinder 6 & 8 Cylinder	4
Station Wagon 59A, B 71A, B, C, D	 6 & 8 Cylinder 6 & 8 Cylinder	5

1964 COMET REAR SPRING ASSEMBLY—USAGE CHART

Model Usage	Engine Usage	No. Leafs
Sedans 62 54	 6 Cylinder 6 Cylinder	4
Sedans & Hardtops 62 54 63	 8 Cylinder 8 Cylinder 6 Cylinder	4
Convertible & Hardtop 76 63	 6 & 8 Cylinder 8 Cylinder	4
Station Wagon 59 71	 6 & 8 Cylinder 6 & 8 Cylinder	5

TIRES

MODELS	TIRE SIZE AND PLY 6 CYLINDER	TIRE SIZE AND PLY 8 CYLINDER	TIRE PRESSURE FRONT	TIRE PRESSURE REAR
Falcon				
Sedan	*6.00 x 13 (2 Ply)	**6.50 x 13 (2 Ply)	24	24
Convertible	6.50 x 13 (2 Ply)	7.00 x 13 (2 Ply)	24	24
Station Wagon	6.50 x 13 (2 Ply)	7.00 x 13 (2 Ply)	24	28
Ranchero	6.50 x 13 (6 Ply)	7.00 x 13 (6 Ply)	24	@
Sedan Delivery	6.50 x 13 (6 Ply)	7.00 x 13 (6 Ply)	24	@
Comet				
Model—202 and 404				
(All) Passenger	6.50 x 14†	6.50 x 14†	24	24
Station Wagon	6.50 x 14	7.00 x 14	24	28
Model—Caliente				
Sedan and Hard Top	6.50 x 14	6.50 x 14	24	24
Convertible	6.50 x 14	7.00 x 14	24	24

*Use 6.50 x 13 With A/C **Use 7.00 x 13 With A/C @ Use 30 p.s.i. in 6 Cylinder Models & 28 p.s.i. in 8 Cylinder Models

†7.00 x 14 used with A/C.

LUBE REQUIREMENTS—STEERING GEAR

Refill Quantity	0.5 lbs ± .05
Type	ESW-M-1C87-A

REAR AXLE

GROUP 4

PART 4-1 GENERAL AXLE SERVICE

1 DIAGNOSIS AND TESTING

Certain rear axle and drive line trouble symptoms are also common to the engine, transmission, tires, and other parts of the car. For this reason, be sure that the cause of the trouble is in the rear axle and not the wheel bearings, tire or drive line before adjusting, repairing, or replacing any of the axle parts.

Since gears are in mesh, some rear axle noise is normal. However, excessive noise often indicates the beginning of other troubles in the axle.

A road test can help determine whether the noise is being caused by trouble in the rear axle or in other parts of the car. **Before road-testing the car, make sure that the tire pressures and the rear axle lubricant level are normal. Then drive the car far enough to warm the axle lubricant to its normal operating temperature.**

With the car stopped and the transmission in neutral, run the engine at various speeds. If the noise still exists during this test, it probably comes from the engine, the exhaust system, the power steering system or some other rotating component.

To determine if the noise is being caused by the rear axle or the tires, drive the car over several different types of road surfaces. Smooth asphalt or black-top roads minimize tire noises. Tire noises may be eliminated by cross-switching the tires. Snow tires often cause noises not heard with conventional tires.

REAR AXLE TROUBLE SYMPTOMS AND POSSIBLE CAUSES

EXCESSIVE REAR AXLE NOISE	Noise caused by a worn or damaged wheel bearing is often loudest when the car is coasting at low speeds, and it usually stops when the brakes are gently applied. To find the noisy bearing, jack up each wheel and check each bearing for roughness while the wheel is rotating. If all possible external sources of noise have been checked and eliminated, and the noise still exists, road test the rear axle under all four driving conditions – drive, cruise, float, and coast. Any noise produced by the side gears and pinions in the differential case will be most pronounced on turns. A continuous whine under a light load between 20 and 35 miles per hour indicates rough or brinnelled pinion bearings. If the tone of drive, coast and float noise differs with speed, and if the noise is very rough and irregular, **worn, rough or loose differential or pinion shaft bearings are indicated.** Then remove, disassemble, and inspect the axle.

CONTINUED ON NEXT PAGE

REAR AXLE TROUBLE SYMPTOMS AND POSSIBLE CAUSES—Continued

EXCESSIVE REAR AXLE BACKLASH	Excessive backlash in the axle driving parts may be caused by worn axle shaft splines, loose axle shaft flange nuts, loose U-joint flange mountings, excessive backlash between the drive pinion and drive gear, excessive backlash in the differential gears, or bearings which are worn or out of adjustment.
DRIVE LINE NOISE OR VIBRATION	Excessive noise or vibration may be caused by lack of lubrication, worn U-joint bearings, missing drive shaft balance weight, and a sprung or damaged drive line. Make the necessary repairs as required. Undercoating on the drive shaft can destroy the balance and cause vibration.

GEAR TOOTH CONTACT PATTERN

Diagnosis of axle gear noise usually starts with checking the gear tooth contact pattern. Paint the gear teeth and roll a pattern. To diagnose the pattern obtained, refer to "Tooth Pattern Check."

In making a final gear tooth contact pattern check, it is necessary to recognize the fact that there are three different types of gear sets: hunting, non-hunting and partial non-hunting. The Falcon and Comet cars use hunting and partial non-hunting gear sets. Each type is determined by the ratio and the number of teeth in the gears. The partial non-hunting types can be identified by the paint "timing" marks on the pinion and drive gear teeth (Fig. 1).

FIG. 1—Timing Mark Location

TOOTH PATTERN CHECK

Figure 2 shows the ideal tooth pattern. **This pattern is not a rigid standard but merely a general standard.**

In general, desirable tooth patterns should have the following characteristics:

(a) The drive pattern should be fairly well centered on the tooth.

(b) The coast pattern should be centered on the tooth but may be slightly toward the toe.

(c) Some clearance between the pattern and the top of the tooth is desirable.

(d) There should be no hard lines where the pressure is high.

The individual gear set need not conform exactly to the "ideal" pattern in order to be acceptable. Characteristic differences between the three types of gear sets as well as differences between individual gear sets of the same type will result in patterns that are acceptable yet different from those shown in Fig. 2.

HUNTING GEAR SET 3.10:1 RATIO

In a hunting type gear set, any one pinion gear tooth comes into contact with all drive gear teeth. In this type, several revolutions of the drive gear are required to make all possible gear contact combinations.

Acceptable Pattern. The drive pattern shown in Fig. 3 was rolled on a hunting type gear set. Since each pinion tooth came into contact with each drive gear tooth, the pattern is a result of the **combined** tooth contacts; therefore, the pattern is uniform from tooth to tooth.

Unacceptable Pattern. An erratic tooth pattern on a hunting gear set indicates gear runout and possible need for gear replacement.

A pattern that is uniform, but off center, indicates that a change in shims or backlash is necessary to correct the tooth contact pattern.

PARTIAL NON-HUNTING GEAR SET 3.20:1, 3.50:1, AND 4.00:1 RATIOS

In a partial non-hunting type gear set, any one pinion tooth comes into contact with only part of the drive gear tooth but more than one revolution of the drive gear is required to make all possible gear tooth contact combinations.

Tooth to tooth pattern uniformity will usually be similar to the hunting gear set patterns. Partial non-hunting gear set patterns will usually be less uniform than hunting gear set patterns.

FIG. 2—The Ideal Tooth Pattern

SHIM AND BACKLASH CHANGES

The patterns shown in Fig. 4 are typical of gear sets that have either an incorrect backlash or an incorrect shim adjustment. Since each gear set rolls a characteristic pattern, the patterns in Fig. 4 should be considered as typical only and should be used as a guide rather than a rigid standard. The drive pattern is rolled on the convex side of the tooth, and the coast pattern is rolled on the concave side.

The movement of tooth contact patterns with changes in backlash and shimming can be summarized as follows:

1. Thicker shim with the backlash constant moves the pinion further from the ring gear:

a. Drive pattern moves toward the top of the tooth (face contact) and toward the heel.

b. Coast pattern moves toward the top of the tooth and slightly toward the toe.

2. Thinner shim with the backlash constant moves the pinion closer to the ring gear:

a. Drive pattern moves deeper on the tooth (flank contact) and slightly toward the toe.

b. Coast pattern moves deeper on the tooth and toward the heel.

3. Decreasing backlash moves the drive gear closer to the pinion:

a. Drive pattern moves slightly lower and toward the toe.

b. Coast pattern moves lower and toward the toe.

4. Increasing backlash moves the drive gear away from the pinion:

a. Drive pattern moves slightly higher and toward the heel.

b. Coast pattern moves higher and toward the heel.

If patterns are not correct, make the changes as indicated. The pinion need not be disassembled to change a shim. All that is required is to remove the pinion, bearing, and retainer assembly and install a different shim. When reinstalling the pinion and retainer assembly of a non-hunting or partial non-hunting gear set, be sure that the marked tooth on the pinion indexes between the marked teeth on the drive gear (Fig. 1). Refer to "Pinion and Drive Gear Tooth Contact Adjustment," Section 2.

FIG. 3—Acceptable Hunting Gear Pattern

2 COMMON ADJUSTMENTS AND REPAIRS

PINION AND DRIVE GEAR TOOTH CONTACT ADJUSTMENT

Two separate adjustments affect pinion and drive gear tooth contact. They are pinion location and backlash.

Individual differences in machining the carrier housing and the gear set require the use of shims (between the pinion retainer and carrier on axles used with V-8 engines; between the rear bearing cone and pinion gear on axles used with Six engines) to locate the pinion for correct contact with the drive gear. The original factory installed shim is of the correct thickness for a given original carrier and gear set assembly. In service, shims should be added or removed from the original pack only as indicated by the tooth pattern check.

On axles with straddle-mounted pinions: add shims to move the pinion **toward** the drive gear; remove shims to move the pinion **away** from the drive gear. On axles with non-straddle-mounted pinions: remove shims to move the pinion **toward** the drive gear; add shims to move the pinion away from the drive gear.

The tooth pattern check also indicates whether the drive gear should be adjusted away from or toward the pinion to increase or decrease backlash between the gears.

If the tooth pattern check indicates a change in backlash only, follow the procedure under "Backlash Between Drive Gear and Pinion." If the tooth pattern indicates a change in shim thickness follow the procedure under "Pinion Location."

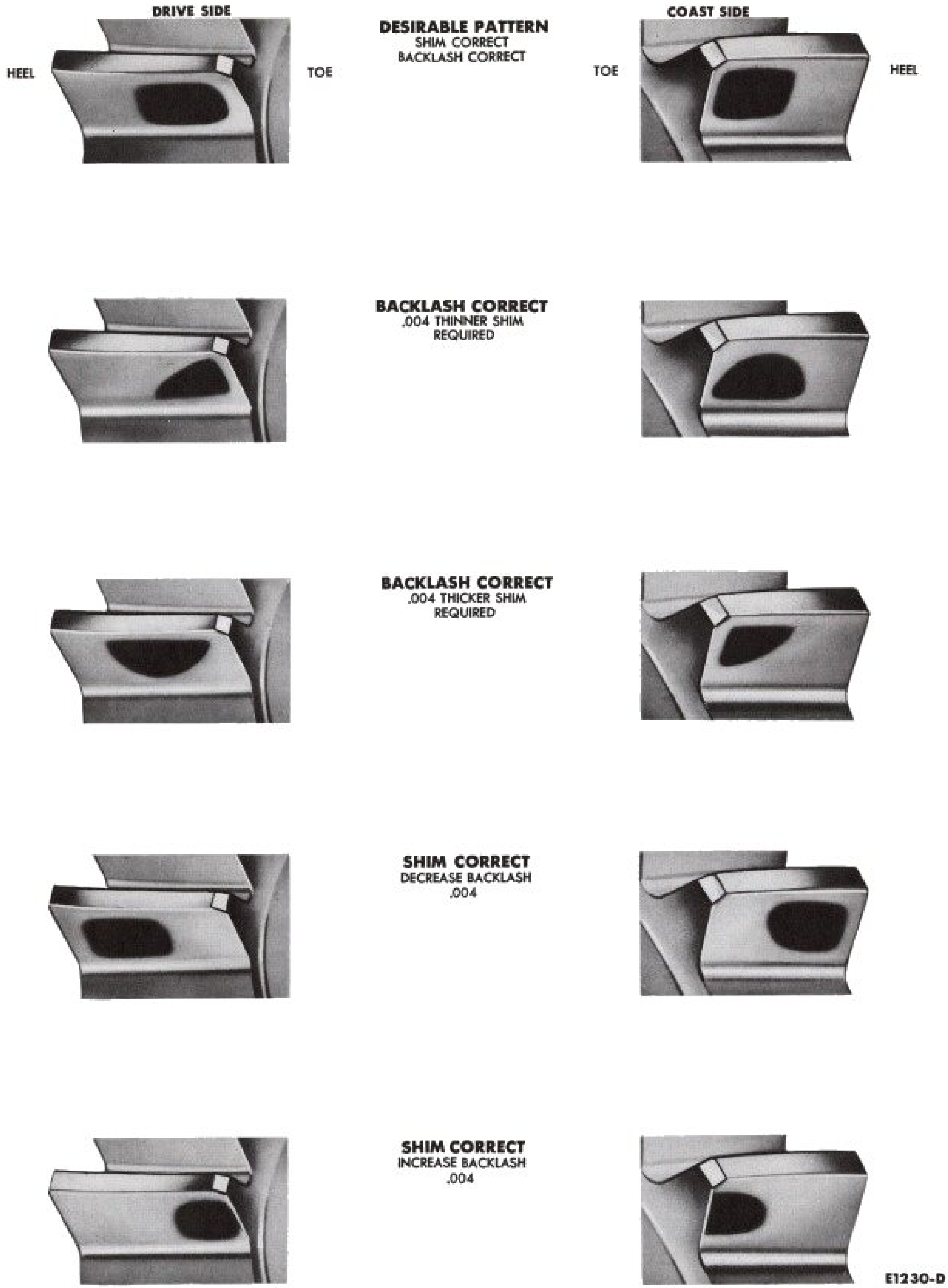


FIG. 4—Typical Gear Tooth Contact Patterns

BACKLASH AND BEARING PRELOAD ADJUSTMENTS

1. Remove the adjusting nut locks, loosen the differential bearing cap bolts, then torque the bolts to specification.

2. **The left-hand adjusting nut is on the drive gear side of the carrier. The right-hand nut is on the pinion side.** Loosen the right-hand nut until it is away from the cup. Tighten the left-hand nut until the drive gear is just forced into the pinion with no backlash. (Recheck the right-hand nut at this time to be sure that it is still loose.) **Tightening the left-hand nut moves the drive gear into the pinion to decrease backlash, and tightening the right-hand nut moves the drive gear away.**

3. Loosen the left-hand adjusting nut 1 to 1½ notches. Tighten the right-hand nut two notches beyond the position where it first contacts the bearing cup. Rotate the drive gear several revolutions in each direction while the bearings are loaded, to seat the bearings in their cups. **This step is important.**

4. Again loosen the right-hand nut to release the pre-load. If there is any backlash between the gears, tighten the left-hand nut just enough to remove this backlash. At this time, make sure that one of the slots in the left-hand nut is so located that the lock can be installed without turning the nut. Carefully tighten the right-hand nut until it just contacts the cup. Set preload of two to three notches tight by the right-hand nut. As preload is applied from the right-hand side, the drive gear is forced away from the pinion and usually results in the correct backlash.

5. Torque the differential cap bolts to specification.

6. Measure the backlash on several teeth around the drive gear. If the measurements vary more than 0.002 inch, there is excessive runout in the gears or their mountings, which must be corrected to obtain a satisfactory unit. If the backlash is out of specification, loosen one adjusting nut and tighten the opposite nut an equal amount, to move the drive gear away from or toward the pinion. **When moving the adjusting nuts, the final movement should always be made in a tightening direction. For example, if the left-hand nut had to be loosened one notch, loosen the nut two notches, then tighten it one. This insures that the nut is contacting the bearing cup, and that the cup cannot shift after being put in service.**

7. Again check the tooth contact pattern. If the pattern is still incorrect, a change in pinion location (shim thickness) is indicated.

3 CLEANING AND INSPECTION

INSPECTION BEFORE DISASSEMBLY OF CARRIER

The differential case assembly and the drive pinion should be inspected before they are removed from the housing. These inspections can help to find the cause of the trouble and to determine the corrections needed.

On axles used with V-8 engines, mount the carrier in the holding fixture shown in Fig. 5.

Wipe the lubricant from the internal working parts, and visually inspect the parts for wear or damage.

Rotate the gears to see if there is any roughness which would indicate defective bearings or chipped gears. Check the gear teeth for scoring or signs of abnormal wear.

Check the differential case and the drive pinion for end play.

Set up a dial indicator (Fig. 6 or 7) and check the backlash at several points around the drive gear.

Backlash should be within specifications as outlined in the Specifications Section, Part 4-3.

To check the gear tooth contact, paint the gear teeth with suitable gear marking compound, such as a paste made with dry red lead and oil. A mixture that is too wet will run and smear. Too dry a mixture cannot be pressed out from between the teeth. Wrap a cloth around the drive pinion flange to act as a brake. Rotate the drive gear back and forth (use a box wrench on the drive gear attaching bolts for a lever) until a clear tooth contact pattern is obtained.

Certain types of gear tooth contact patterns on the drive gear indicate incorrect adjustment. Noise caused by incorrect adjustment can often be corrected by readjusting the gears.

Gear tooth runout can sometimes be detected by an erratic pattern on the teeth. However, a dial indicator should be used to measure the runout of the back face of the drive gear, as shown in Fig. 6 or 8. Refer to Specifications Section for maximum allowable runout.

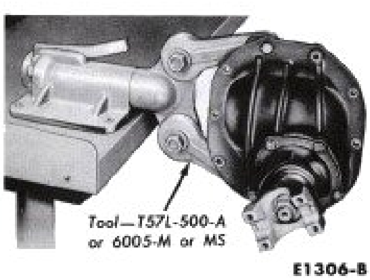


FIG. 5—Bench Fixture for Carrier Overhaul—Axles Used With V-8 Engines

DIFFERENTIAL BEARING CHECK

Loosen the differential bearing cap bolts, and then torque to specification. Remove the adjusting nut locks. Carefully loosen one of the adjusting nuts to determine if any differential bearing preload remains. If at least one notch of preload remains, the differential bearings may be re-used, provided they are not pitted or damaged.

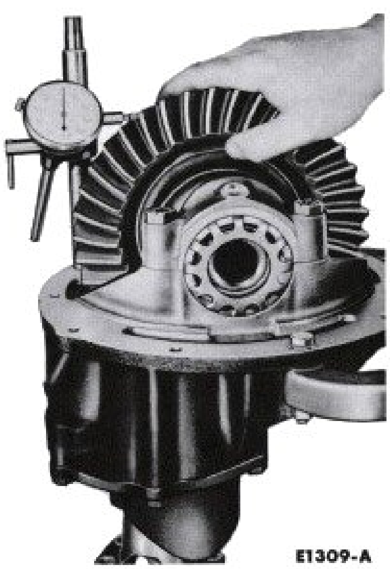


FIG. 6—Backlash Check —V-8 Engine

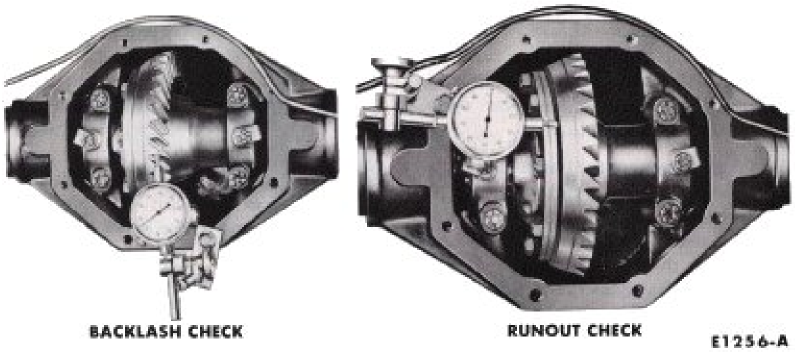


FIG. 7—Backlash Check—Six Engine

INSPECTION AFTER DISASSEMBLY

Thoroughly clean all parts. **Always use new solvent when cleaning bearings.** Do not spin bearings with compressed air. Oil the bearings immediately to prevent rusting. Inspect the parts for any major defects. Clean the inside of the housing before rebuilding and installing the parts.

When a scored gear set is replaced, the axle housing should be washed thoroughly and steam cleaned. This can only be done effectively if the axle shafts and shaft seals are removed from the housing. Inspect individual parts as outlined below.

GEARS

Examine the pinion and drive gear teeth for scoring or excessive wear. **Extreme care must be taken not to damage the pilot bearing surface of the pinion.**

The pattern taken during disassembly should be helpful in judging if gears can be re-used. Worn gears cannot be rebuilt to correct a noisy condition. Gear scoring is the result of excessive shock loading or the use of an incorrect lubricant. Scored gears cannot be re-used.

Examine the teeth and thrust surfaces of the differential gears. Wear on the hub of the differential side gear can cause a "shucking" noise known as "chuckle" when the car is driven at low speeds. Wear on splines, thrust surfaces, or thrust washers can contribute to excessive drive line backlash.

BEARING CUPS

Check bearing cups for rings, scores, galling, or erratic wear patterns. Pinion bearing cups must be solidly seated. Check by attempting to insert a 0.0015-inch feeler between these cups and the bottoms of their bores.

CONE AND ROLLER ASSEMBLIES

When operated in the cups, bearing rollers must turn without roughness. Examine the roller ends for wear. Step-wear on the roller ends indicates the bearings were not preloaded properly or the rollers were slightly misaligned.

If inspection reveals either a defective cup or a defective cone and roller assembly, **both parts should be replaced to avoid early failure.**

DIFFERENTIAL BEARING ADJUSTING NUTS

Temporarily install the bearing caps and test the fit of the adjusting nuts in their threads.

The nuts should turn easily when the caps are tightened to specification. The faces of the nuts that contact the bearing cups must be smooth and square. Polish these with a fine abrasive on a flat surface. Replace the nuts or examine the threads in the carrier, if their fit is not proper. Be sure that the bearing caps are on the side they were machined to fit by observing the punch marks and scribe marks made during disassembly operations.

DRIVE PINION FLANGE

Be sure that the ears of the flange have not been damaged in removing the drive shaft or in removing the flange from the pinion. The end of the flange that contacts the bearing cone must be smooth. Polish this face if necessary. Roughness aggravates backlash noises, and causes wear of the flange with a resultant loss in pinion bearing preload.

PINION RETAINER — CARS WITH V-8 ENGINE

Be sure that the pinion bearing cups are seated. Remove any chips or burrs from the mounting flange. Clean the groove for the O-ring seal and all lubricant passages. If the cups were removed, examine the bores carefully. Any nicks or burrs in these bores must be removed to permit proper seating of the cups.

CARRIER HOUSING

Make sure that the differential bearing bores are smooth and the threads are not damaged.

Remove any nicks or burrs from the mounting surfaces of the carrier housing.

DIFFERENTIAL CASE

Make sure that the hubs where the bearings mount are smooth. Carefully examine the differential case bearing shoulders which may have been damaged when the bearings were removed. The bearing assemblies will fail if they do not seat firmly against the shoulders. Check the fit (free rotation) of the differential side gears in their counterbores. Be sure that the mating surfaces of the two parts of the case are smooth and free from nicks or burrs.

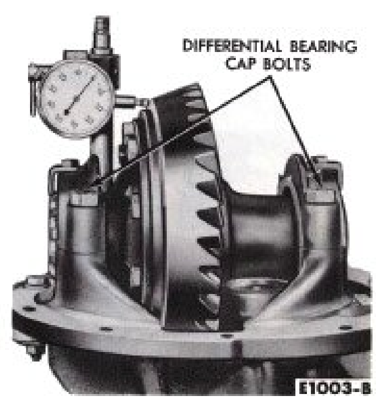


FIG. 8—Drive Gear Runout Check—Axle Used With V-8 Engine

PART 4-2 AXLES USED WITH SIX AND V-8 ENGINES

1 DESCRIPTION AND OPERATION

DESCRIPTION

AXLES USED WITH SIX ENGINE

The rear axle assembly is an integral-type housing, hypoid design, with the centerline of the pinion set below the centerline of the ring gear (Fig. 1).

The full floating axle shafts are retained in the housing by ball bearings and a bearing retainer at the axle housing outer ends.

The differential assembly is mounted on two opposed tapered roller bearings. The bearings are retained in the housing by removable caps. Differential bearing pre-load and drive gear backlash is adjusted by nuts located behind each differential bearing cup.

The drive pinion assembly is mounted on two opposed tapered roller bearings. Pinion bearing preload is adjusted by a collapsible spacer on the pinion shaft. Pinion and drive gear tooth contact is adjusted by shims between the rear bearing cone and pinion gear.

A cover on the rear of the differential housing provides access for inspection and the removal and installation of the differential assembly and drive pinion.

A metal tag, stamped with the axle model, gear ratio, date and manufacturing code is secured to the differential housing by one of the cover bolts.

AXLES USED WITH V-8 ENGINE

The rear axle is of the banjo-housing, hypoid gear type, in which the centerline of the pinion is mounted below the centerline of the drive gear (Fig. 2).

The integral pinion gear and shaft and the pinion bearings are assembled in a pinion retainer, which is bolted to the carrier. In this axle, the pinion is straddle mounted; that is, the pinion is supported by bearings both in front of and to the rear of the pinion gear. Two opposed tapered roller bearings support the pinion shaft in front of the pinion gear. A straight roller (pilot) bearing supports the pinion shaft at the rear of the pinion gear.

The differential assembly is mounted on two opposed tapered roller bearings, which are retained in the carrier by removable caps. The

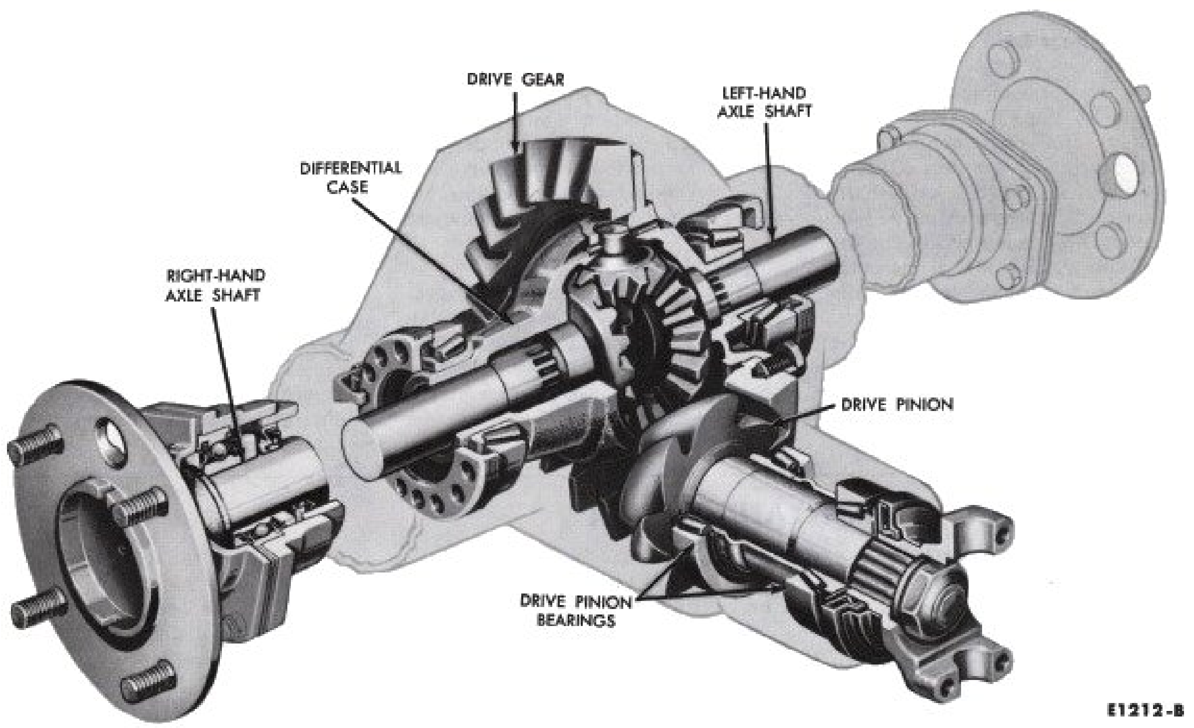


FIG. 1—Typical Rear Axle Assembly—Used With Six Engine

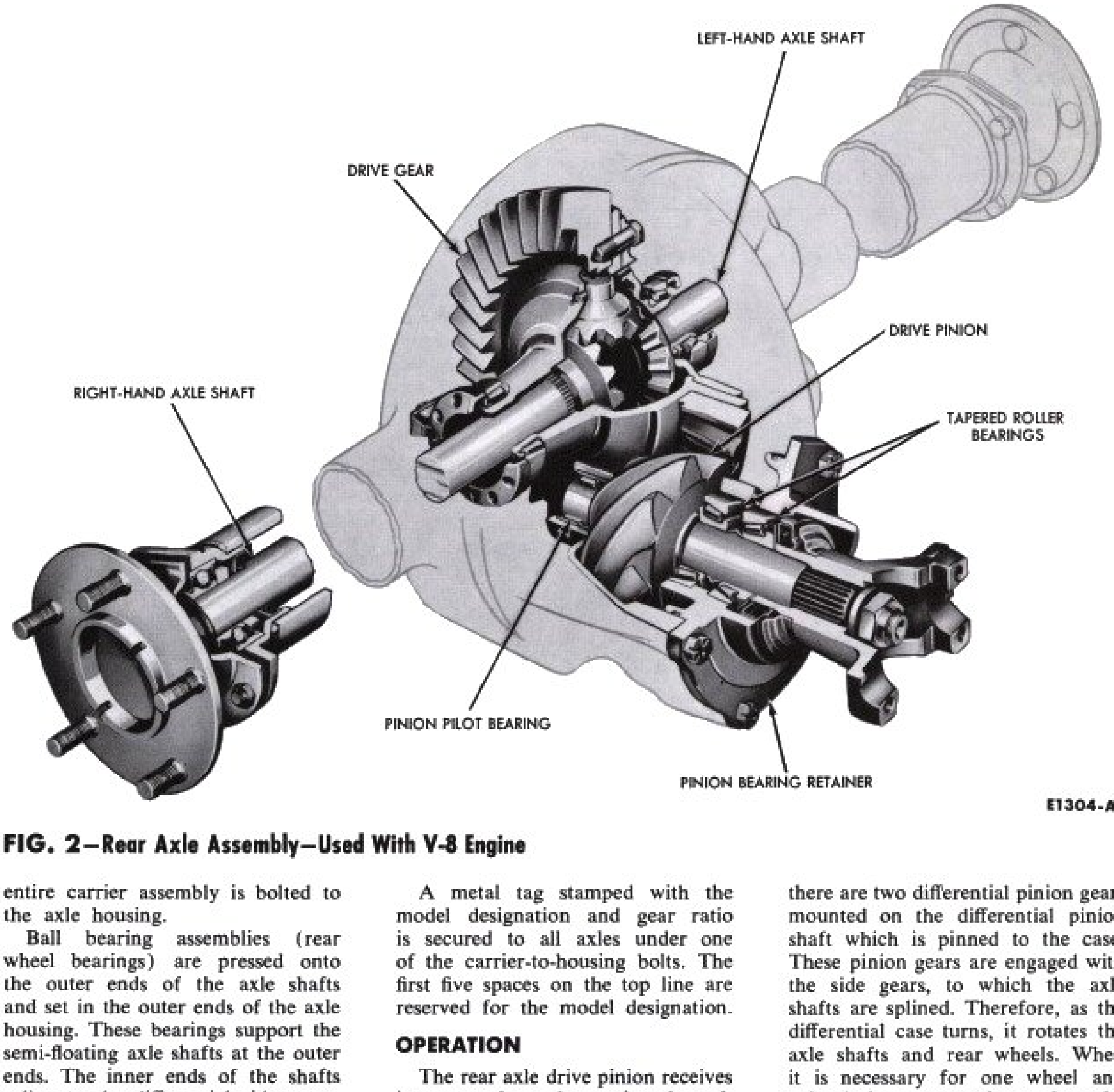


FIG. 2—Rear Axle Assembly—Used With V-8 Engine

entire carrier assembly is bolted to the axle housing.

Ball bearing assemblies (rear wheel bearings) are pressed onto the outer ends of the axle shafts and set in the outer ends of the axle housing. These bearings support the semi-floating axle shafts at the outer ends. The inner ends of the shafts spline to the differential side gears. Bearing retainer plates hold the shafts in the housing. The left and right axle shafts are not interchangeable, because the left axle shaft is shorter than the right.

A metal tag stamped with the model designation and gear ratio is secured to all axles under one of the carrier-to-housing bolts. The first five spaces on the top line are reserved for the model designation.

OPERATION

The rear axle drive pinion receives its power from the engine through the transmission and drive shaft. The pinion gear rotates the differential case through engagement with the drive gear, which is bolted to the case outer flange. Inside the case, there are two differential pinion gears mounted on the differential pinion shaft which is pinned to the case. These pinion gears are engaged with the side gears, to which the axle shafts are splined. Therefore, as the differential case turns, it rotates the axle shafts and rear wheels. When it is necessary for one wheel and axle shaft to rotate faster than the other, the faster turning side gear causes the pinions to roll on the slower turning side gear to allow differential action between the two axle shafts.

2 IN-CAR ADJUSTMENT AND REPAIR

REAR AXLE SHAFT, WHEEL BEARING AND OIL SEAL REPLACEMENT

The rear axle shafts, wheel bearings, and oil seals can be replaced without removing the differential assembly from the axle housing

1. Remove the wheel and tire from the brake drum.

2. Remove the nuts that secure the brake drum to the axle flange, then remove the drum from the flange. Back-off brake adjuster if drum does not remove fully.

3. Working through the hole provided in the axle shaft flange, remove the nuts that secure the wheel bearing retainer. Then pull the axle shaft assembly out of the axle housing (Fig. 3). **The brake carrier plate must not be dislodged. Install one nut to hold the plate in place after the axle shaft is removed.**

4. If the rear wheel bearing is to be replaced, loosen the inner retainer. The retainer will become loose

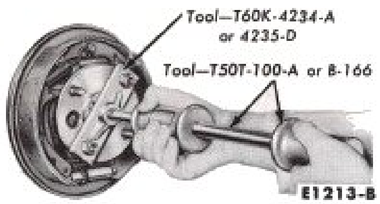


FIG. 3—Axle Shaft Removal

on the shaft, if it is nicked deeply in several places with a chisel (Fig. 4).

5. Remove the bearing from the axle shaft with the tool shown in Fig. 5 or 6.

6. Inspect the machined surface of the axle shaft and the axle housing for rough spots or other irregularities which would affect the sealing action of the oil seal. Carefully remove any burrs or rough spots.

7. With the tool shown in Fig. 5 or 6 press a new rear wheel bearing on the axle shaft. **The bearing should seat firmly against the shaft shoulder.**

8. With the bearing installation tool, press the bearing inner retainer on the shaft until the retainer seats firmly against the bearing.

9. Whenever the axle shafts have been removed for any reason, the oil seals should be replaced. Remove and replace the seal with the tools shown in Fig. 7. Soak the new seal in light weight engine oil (SAE 10) for ½ hour before using. **Installation without use of the proper tool will distort the seal and cause leakage.**

Coat the outside edges of the new oil seal with a hardening type of sealer such as Permatex No. 2 or its equivalent, and wipe all lubricant from the inside of the axle housing in the area of the oil seal before installing the new seal.

10. Place a new gasket on the brake carrier plate, and then slide the axle shaft into the housing. Start the axle splines into the side gear, and push the shaft in until the bearing bottoms in the housing.

11. Install the bearing retainer and

FIG. 4—Rear Wheel Bearing Retainer Removal

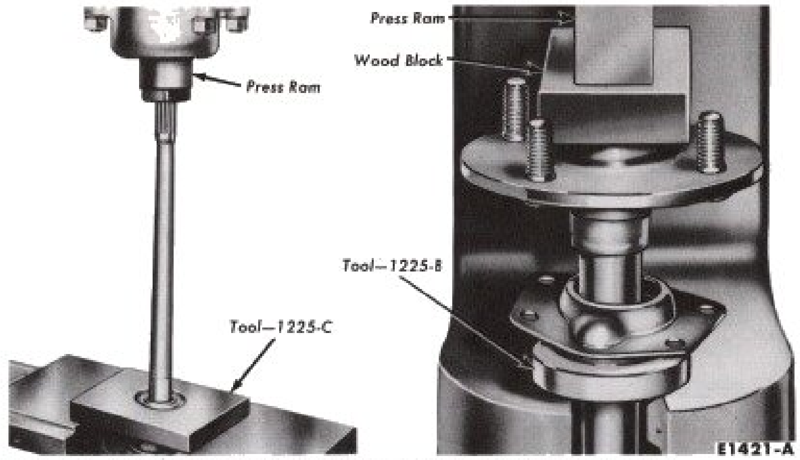


FIG. 5—Rear Wheel Bearing Removal and Installation—Comet

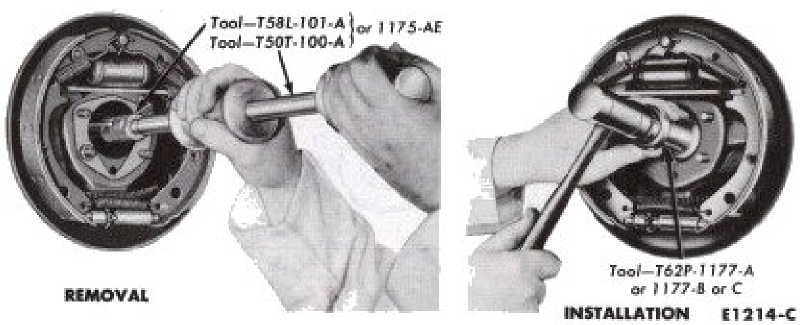


FIG. 7—Axle Shaft Seal Removal and Installation

FIG. 8—Typical Drive Pinion Shaft Nut Removal

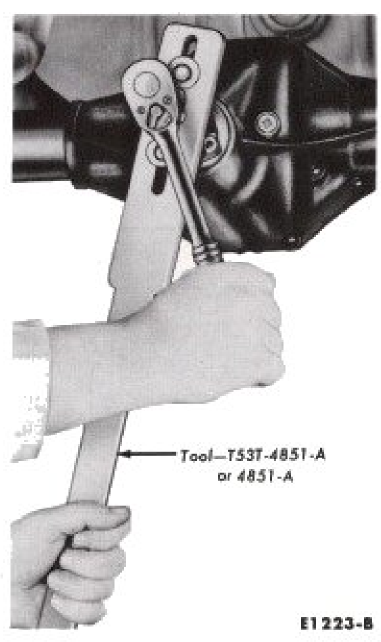


FIG. 9—Typical Drive Pinion Flange Removal

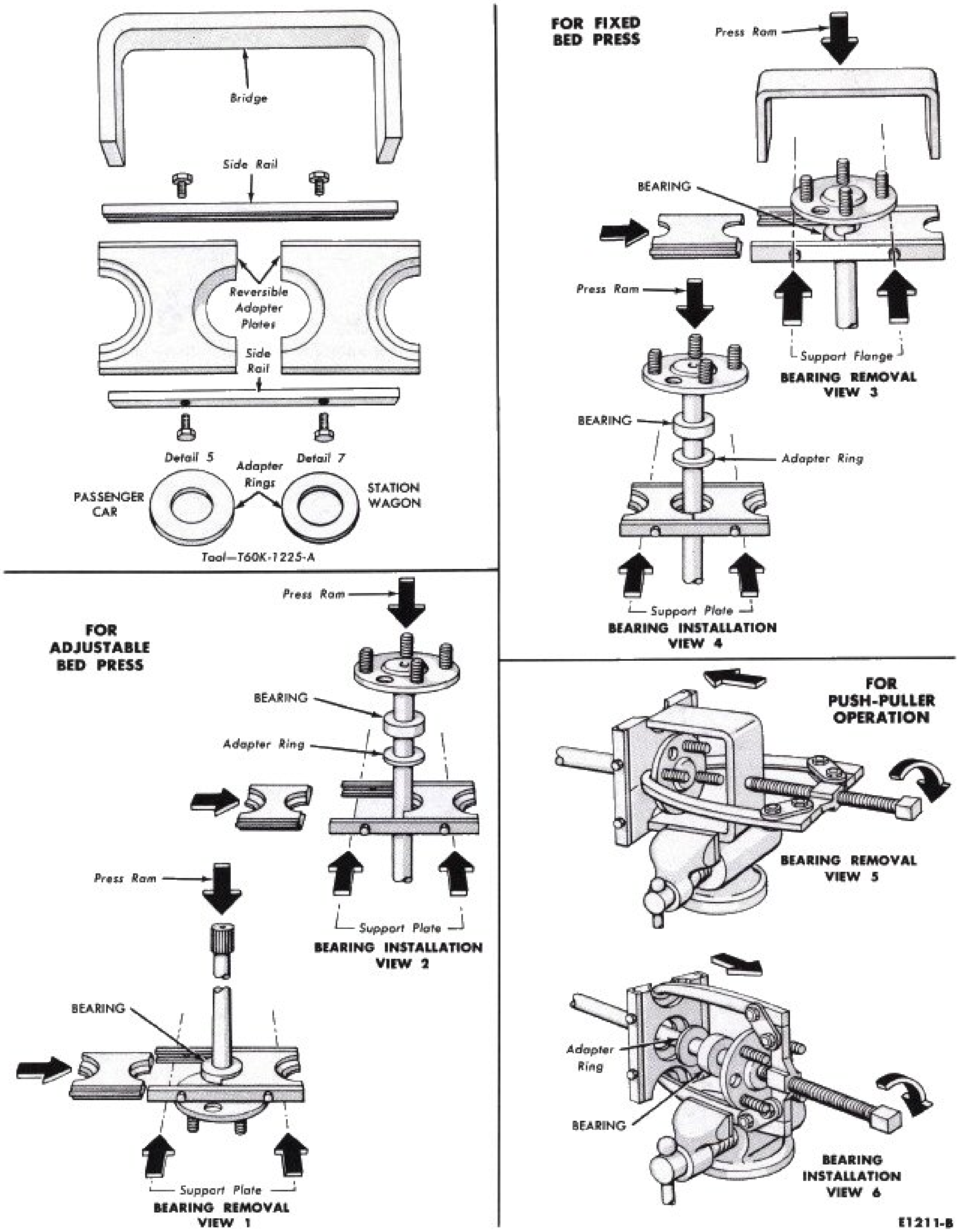


FIG. 6—Rear Wheel Bearing Removal and Installation—Falcon

the nuts that secure it. Torque the nuts to specification.

12. Install the brake drum and retaining nuts. Adjust the brakes.

13. Install the wheel and tire.

DRIVE PINION OIL SEAL REPLACEMENT

Soak the new seal in light weight engine oil (SAE 10) for ½ hour before using.

1. Disconnect the drive shaft from the drive pinion flange. Pull the drive shaft toward the rear of the car until the front U-joint yoke clears the transmission extension housing. Install an extension housing seal installer tool to prevent lubricant leakage.

2. Mark the pinion shaft nut, the end of the pinion shaft, and the pinion flange splines for realignment.

3. Hold the flange with the tool

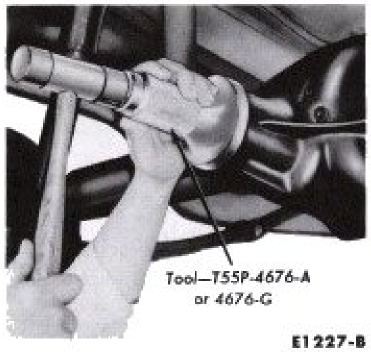


FIG. 10—Typical Drive Pinion Flange Seal Installation

shown in Fig. 8. Remove the pinion shaft nut.

4. Remove the pinion flange with the tool shown in Fig. 9.

5. Remove the pinion oil seal with tool 1175-AE.

6. Clean the oil seal seat. The seal lubricant-return passage must be clear.

7. Coat the outer edge of the new seal with oil-resistant sealer, and install the seal, using the tool shown in Fig. 10.

8. Align the pinion flange spline mark with the pinion shaft spline mark, and install the flange.

9. Install the pinion shaft nut. Tighten the nut until the marks are aligned, then turn ¼ of a turn past the alignment marks.

10. Remove the extension housing seal driver tool and install the front U-joint yoke to the transmission output shaft. Connect the rear yoke of the drive shaft to the pinion flange.

11. Fill the axle with new lubricant. The level should be maintained at the bottom of the filler hole.

3 REMOVAL AND INSTALLATION

REMOVAL

1. Raise the car and support it with safety stands under rear frame member.

2. Drain the lubricant from the axle.

3. Disconnect the drive shaft at the drive pinion flange.

4. Disconnect the lower end of the shock absorbers.

5. Remove both axle shafts.

6. Remove vent hose front vent tube (Corbin clamp) and remove vent tube from brake tube junction and axle housing.

7. Remove the hydraulic brake T-fitting from the axle housing. **Do not open the hydraulic brake system lines.** Remove the hydraulic brake line from its retaining clip on the axle housing.

8. Remove both brake carrier plates from the axle housing and suspend them above the housing with mechanic's wire. The hydraulic brake lines and the parking brake cables are still attached to the brake carrier plates.

9. Support the rear axle housing on a jack, and then remove the spring clip nuts. Remove the spring clip plates (Fig. 11).

10. Lower the axle housing and remove it from under the car.

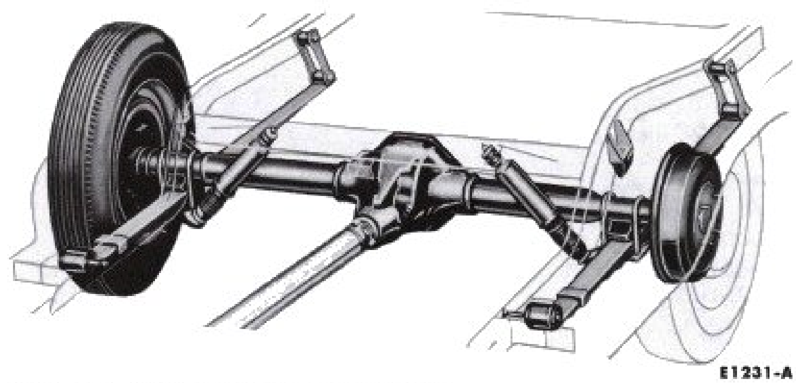


FIG. 11—Typical Rear Axle Installation

INSTALLATION

1. Raise the axle housing into position so that the spring clip plates can be installed. Torque the spring clip nuts to specification.

2. Place the brake carrier plates in their normal position on the axle housing. Use new gaskets on each side of the brake carrier plates.

3. Install new axle shaft oil seal with tool shown in Fig. 7. Soak the new seal in light weight engine oil (SAE 10) for ½ hour before installing them. **Installation without use of the proper tool will distort the seal and cause leakage.** Coat the outside edges of the new oil seal with a hardening type of sealer such as Permatex No. 2 or its equivalent.

4. Install the axle shafts, brake drums and wheels.

5. Attach the hydraulic brake line "T" fitting to the axle housing, and secure the hydraulic brake line in its retainer on the axle housing.

6. Install vent tube to brake tube junction and install vent hose to vent tube.

7. Raise the axle housing and connect the shock absorbers.

8. Connect the drive shaft at the drive pinion shaft.

9. Fill the axle with the proper grade and amount of lubricant.

10. Road test the car.

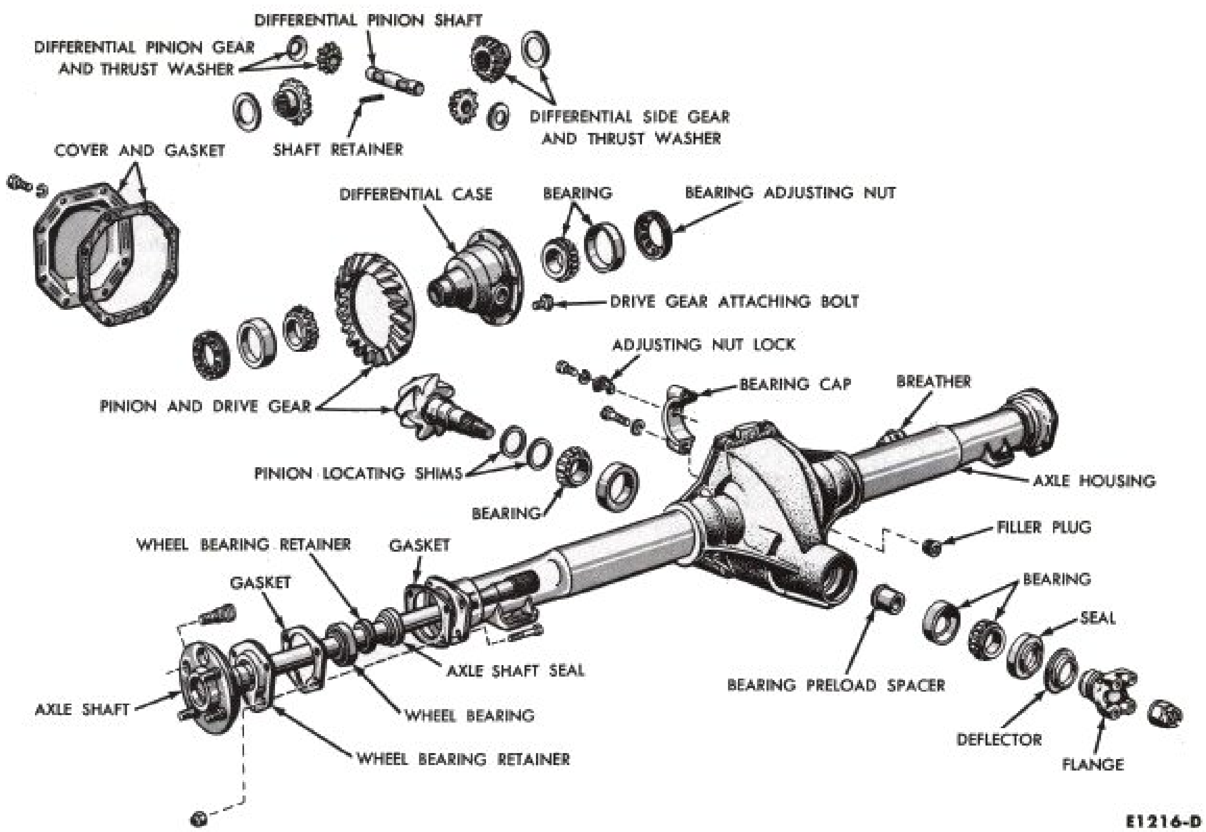


FIG. 12—Disassembled Rear Axle

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

AXLES USED WITH SIX CYLINDER ENGINE

All service operations on the differential case assembly and the drive pinion assembly can be performed with the housing in the car.

Refer to Part 4-1 for Cleaning and Inspection procedures before starting the disassembly operations.

DIFFERENTIAL CASE AND DRIVE PINION REMOVAL

1. Remove driveshaft.
2. Remove axle shafts.
3. Remove the cover from the rear of the axle housing.
4. Remove the differential bearing adjusting nut locks (Fig. 12).
5. Mark one differential bearing cap and the case (Fig. 13) to help position the parts properly during assembly.
6. Remove the differential bearing cap bolts and bearing caps. **Hold the differential case assembly in the housing after the caps are removed.**
7. Remove the differential case and bearing cups (Fig. 14).
8. Hold the drive pinion flange and remove the pinion nut (Fig. 8).
9. Remove the pinion flange (Fig. 9).
10. With a soft-faced hammer, drive the pinion out of the front bearing cone and remove it through the rear of the carrier casting.
11. Drive against the pinion front bearing cone, and drive the pinion flange seal and the bearing cone out of the front of the carrier casting.

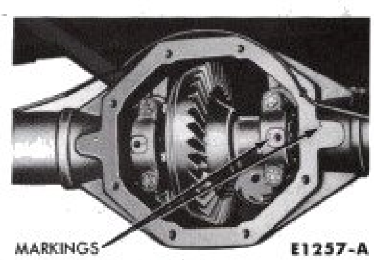


FIG. 13—Typical Differential Bearing Cap Marking

12. If the pinion bearing cups are to be replaced, drive them out of the carrier casting with a drift. Install the new cups with the tool shown in Fig. 15. Make sure the cups are properly seated in their bores. If a 0.0015-inch feeler gauge can be inserted between a cup and the bottom of its bore at any point

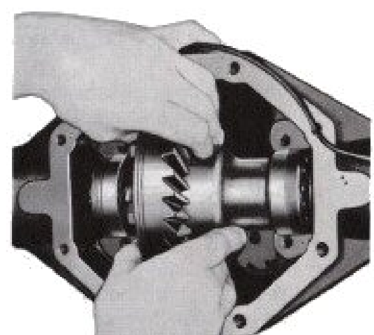


FIG. 14—Typical Differential Case Removal

TABLE 1—Drive Pinion Adjusting Shim Thickness Changes (Inches)

Old Pinion Marking	New Pinion Marking								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

around the cup, the cup is not properly seated.

13. To remove and install the pinion rear bearing cone use the tools in Fig. 16.

14. Measure the shim which is found under the bearing cone with a micrometer. Record the thickness of the shim.

DIFFERENTIAL CASE DISASSEMBLY

1. If the differential bearings are to be removed, use the tools shown in Fig. 17 to remove the old bearing and install the new bearings.

2. Remove the bolts that attach the drive gear to the differential case. Press the drive gear from the case or tap it off with a soft-faced hammer.

3. With a drift, drive out the differential pinion shaft retainer (Fig. 18).

4. Drive out the pinion shaft with a drift. Remove the gears and thrust washers.

PARTS REPAIR OR REPLACEMENT

DRIVE PINION ASSEMBLY AND INSTALLATION

Shim Selection. Individual differences in machining the carrier casting and the gear set require a shim between the pinion rear bearing cone and the pinion gear to locate the pinion for correct tooth contact with the drive gear. In order to adjust the shim pack to the correct thickness for a given gear set, each pinion gear is marked with an adjustment number such as the +2 marking in Fig. 19.

When replacing a drive gear and pinion it should be noted that the **original** factory installed shim is of the correct thickness to adjust for individual variations in **both** the carrier casting dimension and in the original gear set dimension; therefore, to select the correct shim thickness for the new gear set to be installed, follow these steps:

1. Measure the thickness of the **original shim** with a micrometer.

2. Note the shim adjustment number on both the old pinion and the new pinion.

3. Refer to Table 1 to determine the correct amount of shim thickness change. The amount shown in Table 1 under the old pinion shim adjustment number and in line with the new pinion number is the amount

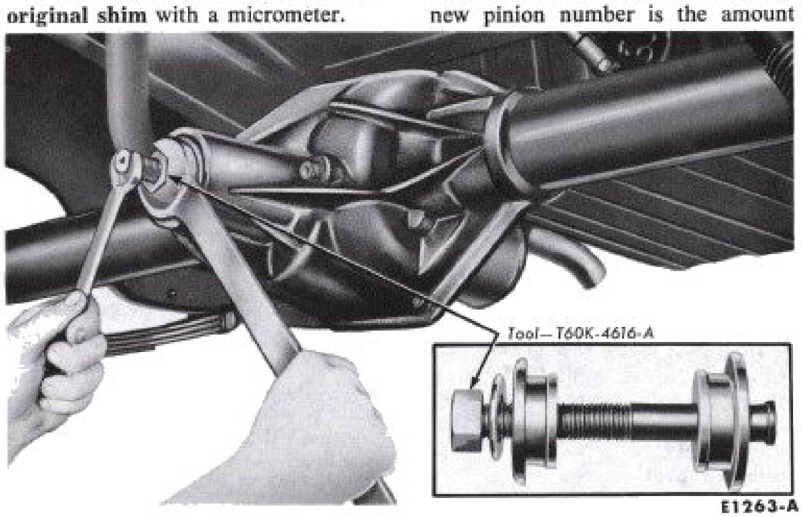


FIG. 15—Pinion Bearing Cup Removal or Installation

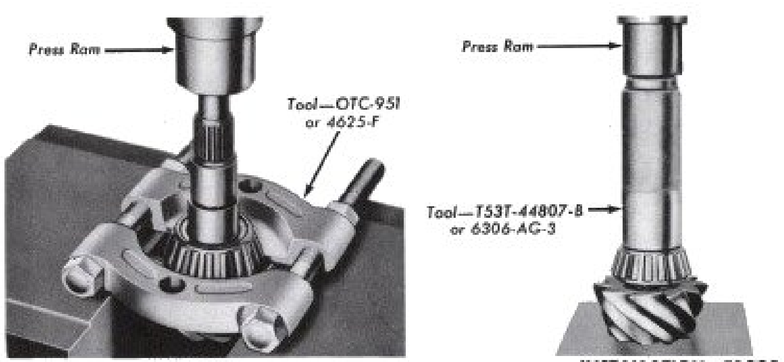


FIG. 16—Pinion Rear Bearing Cone Removal and Installation

of **change** that should be made to the **original** shim thickness.

If the old pinion is marked +4, for example, and the new pinion is marked −2, the table indicates that 0.006 inch of shim stock should be added to the **original** shim pack.

If the **original** shim pack was lost or if a new carrier casting is being installed, substitute a **nominal** 0.018 inch shim for the **original,** and follow the foregoing procedure for a trial build-up. If any further shim change is neccessary, it will be indicated in the tooth pattern check.

A new drive gear and pinion should always be installed in an axle as a matched set (never separately). **Be sure that the same matching number appears on both the drive pinion and the drive gear.** Note the number "818" in Fig. 19.

Before installing the pinion, determine which type of gear set is being used. The **non-hunting** and **partial non-hunting** types can be identified by the paint "timing" marks on the gear teeth (Fig. 1, Part 4-1).

If the gear set is of the **non-hunting** or **partial non-hunting** type, clean the teeth on both the pinion and drive gear so that the timing marks are visible. Rotate the differential case and drive gear assembly in the carrier until the marked teeth on the drive gear are opposite the pinion entry hole. Place the assembly in the carrier so that the marked tooth on the pinion indexes between the marked teeth on the drive gear.

In almost every case of improper assembly (gear assembled out of time), the noise level and probability of failure will be higher than they would be with properly assembled gears.

ASSEMBLY

Refer to Part 4-1 for cleaning and inspection before starting assembly operations.

1. Place the shim and pinion rear bearing cone on the pinion shaft. Press the bearing and shim firmly against the pinion shaft shoulder (Fig. 16).
2. Place a **new** pinion bearing preload spacer on the pinion shaft.
3. Lubricate the pinion rear bearing with axle lubricant.
4. Lubricate the pinion front bearing cone and place it in the housing.
5. Coat the outside edge of a new oil seal with an oil resistant sealer and install it in the carrier casting (Fig. 10).
6. Insert the drive pinion shaft flange into the seal and hold it firmly against the pinion front bearing cone. From the rear of the carrier casting, insert the pinion shaft into the flange.
7. Place the flat washer on the pinion shaft and start the nut. Use a new nut. Hold the flange with the tool shown in Fig. 8 and tighten the pinion shaft nut. As the pinion shaft nut is tightened, the pinion shaft is pulled into the front bearing cone and into the flange.

As the pinion shaft is pulled into the front bearing cone, pinion shaft end play is reduced. While there is still end play in the pinion shaft, the flange and cone will be felt to bottom. This indicates that the bearing cone and flange have bottomed on the collapsible spacer.

From this point, a much greater torque must be applied to turn the pinion shaft nut, since the spacer must be collapsed. From this point, also, the nut should be tightened very slowly and the pinion shaft end play checked often, so that the pinion bearing preload does not exceed the limits.

If the pinion shaft nut is tightened to the point that pinion bearing preload exceeds the limits, the pinion shaft must be removed and a new collapsible spacer installed. **Do not decrease the preload by loosening the pinion shaft nut.** This will remove the compression between the pinion front and rear bearing cones and the collapsible spacer and may permit the front bearing cone to turn on the pinion shaft.

8. As soon as there is preload on the bearings, **turn the pinion shaft in both directions several times to seat the bearing rollers.**
9. Adjust the bearing preload to specification. Measure the preload with the tool shown in Fig. 20.

DIFFERENTIAL CASE ASSEMBLY

1. Lubricate all the differential parts with axle lubricant, before they are installed in the case.
2. Place the side gears and thrust washers in the case.
3. Place the two pinion gears and thrust washers exactly opposite each other in the case openings and in mesh with the side gears.
4. Turn the pinions and thrust washers until the holes in the pinion gears align with the pinion shaft holes in the case.
5. Start the pinion shaft into the differential case. Carefully align the shaft retaining pin hole with the pin hole in the case. Drive the shaft into place and install the retaining pin (Fig. 18).
6. Place the drive gear on the differential case and install the bolts. Torque the bolts to specification.

INSTALLATION

1. Wipe a thin coating of lubricant on the bearing bores so that the differential bearing cups will move easily.
2. Place the cups on the bearings and set the differential case assembly in the carrier casting (Fig. 14).

Slide the case assembly along the bores until a slight amount of backlash is felt between the gear teeth. Hold the differential case in place.

3. Set the adjusting nuts in the bores so that they just contact the bearing cups.
4. Carefully position the bearing caps on the carrier casting. Match the marks made when the caps were removed.
5. Install the bearing cap bolts and lockwashers. As the bolts are tightened, turn the adjusting nut with the tool shown in Fig. 21.
6. If the adjusting nuts do not turn freely as the cap bolts are tightened, remove the bearing caps and again inspect for damaged threads or incorrectly positioned caps. Tightening the bolts to the specified torque is done to be sure that the cups and adjusting nuts are seated. Loosen the cap bolts, and torque them to only 5 ft-lbs before making adjustments. Refer to Part 4-1 for adjustment procedures.

DISASSEMBLY

AXLES USED WITH V-8 ENGINE

DIFFERENTIAL CASE AND DRIVE PINION REMOVAL

1. Place a drain pan under the carrier and housing to catch the old lubricant, when the carrier is separated from the housing.
2. Use a wire brush to clean dirt from the area around the carrier and housing mating surfaces (Fig. 22). Then wipe the area clean with a cloth dampened with solvent.
3. Remove the axle shafts and the drive shaft.
4. Remove the nuts which attach the differential carrier to the housing, and then remove the carrier from the housing.

DISASSEMBLY OF DIFFERENTIAL CARRIER

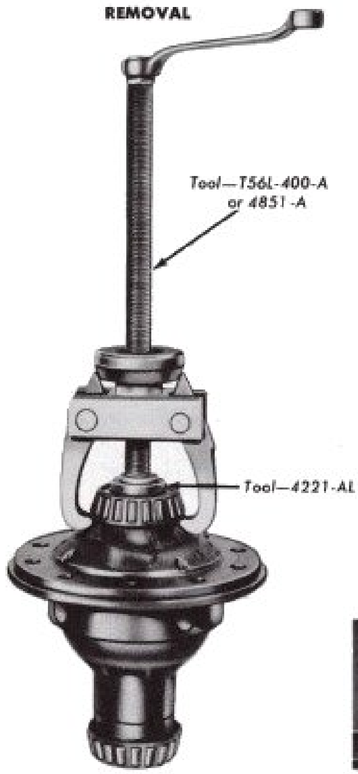
1. Mark 1 differential bearing cap and the mating bearing support to help position the parts properly during assembly of the carrier.

2. Remove the adjusting nut locks, bearing caps, and adjusting nuts. Then lift the differential assembly out of the carrier.

3. If the differential bearings are to be removed, use the tool shown in Fig. 23.

4. Remove the bolts that attach the drive gear to the differential case. Press the drive gear from the case or tap it off with a soft-faced hammer.

5. With a drift, drive out the differential pinion shaft retainer (Fig. 24), and separate the 2-piece differential case.



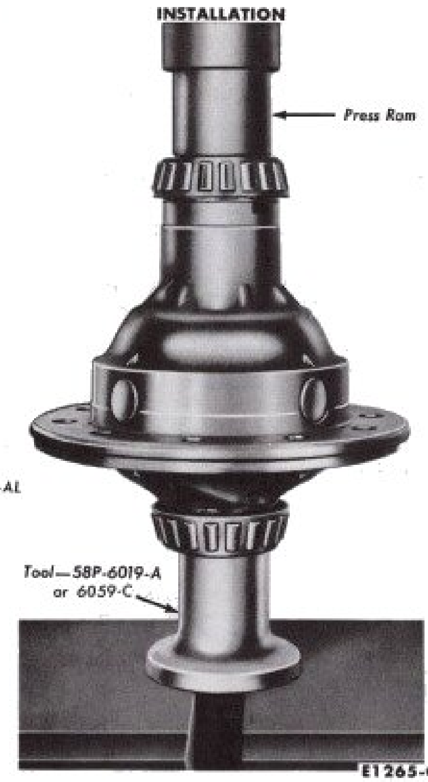


FIG. 17—Differential Bearing Removal and Installation

FIG. 18—Differential Pinion Shaft Retainer Removal

6. Drive out the pinion shaft (Fig. 25) with a brass drift. Remove the gears and thrust washers.

7. Turn the carrier case upright, and remove the pinion shaft nut (Fig. 26). Then remove the U-joint flange (Fig. 27).

8. Remove the seal (Fig. 28) and the slinger.

9. Remove the pinion shaft and bearing retainer from the carrier housing. Measure the shim thickness with a micrometer. **Extreme care must be taken not to damage the mounting surfaces of the retainer and carrier.**

10. If the pilot bearing is to be replaced, use the tool shown in Fig. 29 to drive the pilot bearing and the bearing retainer out together. To install the bearing, use the same tool (Fig. 30), and drive the bearing in until it bottoms.

11. Place a protective sleeve (hose) on the pinion pilot bearing surface. Press the pinion shaft out of the pinion front bearing cone (Fig. 31).

12. Remove the pinion rear bearing cone (Fig. 32).

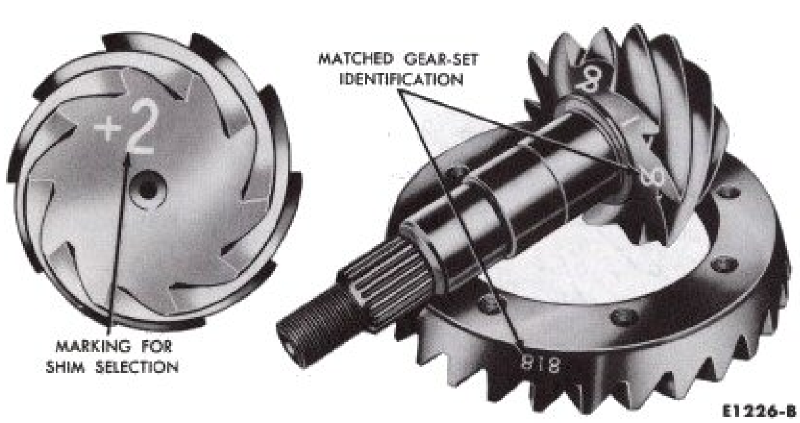


FIG. 19—Gear Set Markings

13. Do not remove the pinion bearing cups from the retainer unless the cups are worn or damaged. The flange and pilot of the retainer are machined during manufacture by locating on these cups, after they are installed in their bores. If the cups are worn or damaged, they may be removed and replaced as shown in Figs. 33 and 34.

After the new cups are installed, make sure they are seated in the retainer by trying to insert a 0.0015-inch feeler gauge between the cup and the bottom of the bore.

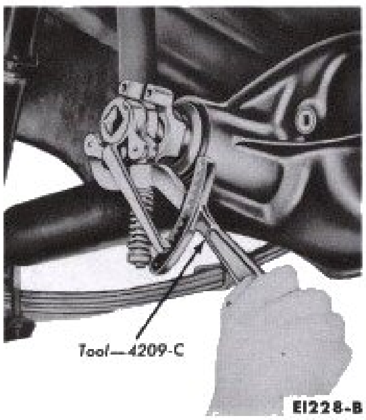


FIG. 20—Pinion Bearing Pre-Load Check

PARTS REPAIR OR REPLACEMENT

SHIM SELECTION

Manufacturing tolerances in the carrier housing and the gear set require a shim between the pinion retainer and the carrier housing. This will locate the pinion for correct tooth contact with the drive gear.

It is a manufacturing objective to machine the carrier housing so that it will locate the pinion at its designed distance (nominal dimension) from the center line of the drive gear with a 0.020-inch (nominal) shim. Due to individual differences in machining, however, the carrier housing may have to be restored to its nominal dimension by increasing or decreasing the nominal 0.020-inch shim pack. Thus, the **actual housing assembly shim** thickness may be **0.020 inch** in the case of a housing machined exactly to nominal dimension; or it may be 0.020 inch **plus or minus** in the case of a housing machined to a dimension slightly greater or less than nominal, but within the allowable tolerance.

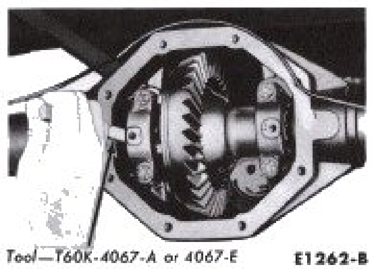


FIG. 21—Backlash and Bearing Pre-Load Adjustment

It is also a manufacturing objective to machine the gear set so that it will obtain correct tooth contact when located at nominal dimension. Individual differences in machining the gear set may require that the pinion be located at a dimension slightly greater or less than nominal for correct tooth contact. Thus, when the gear set is installed, the **actual housing assembly shim** pack may be increased or decreased to move the pinion away from or closer to the drive gear. The +1 marking on the pinion gear (Fig. 35) indicates that a shim 0.001-inch thicker than the

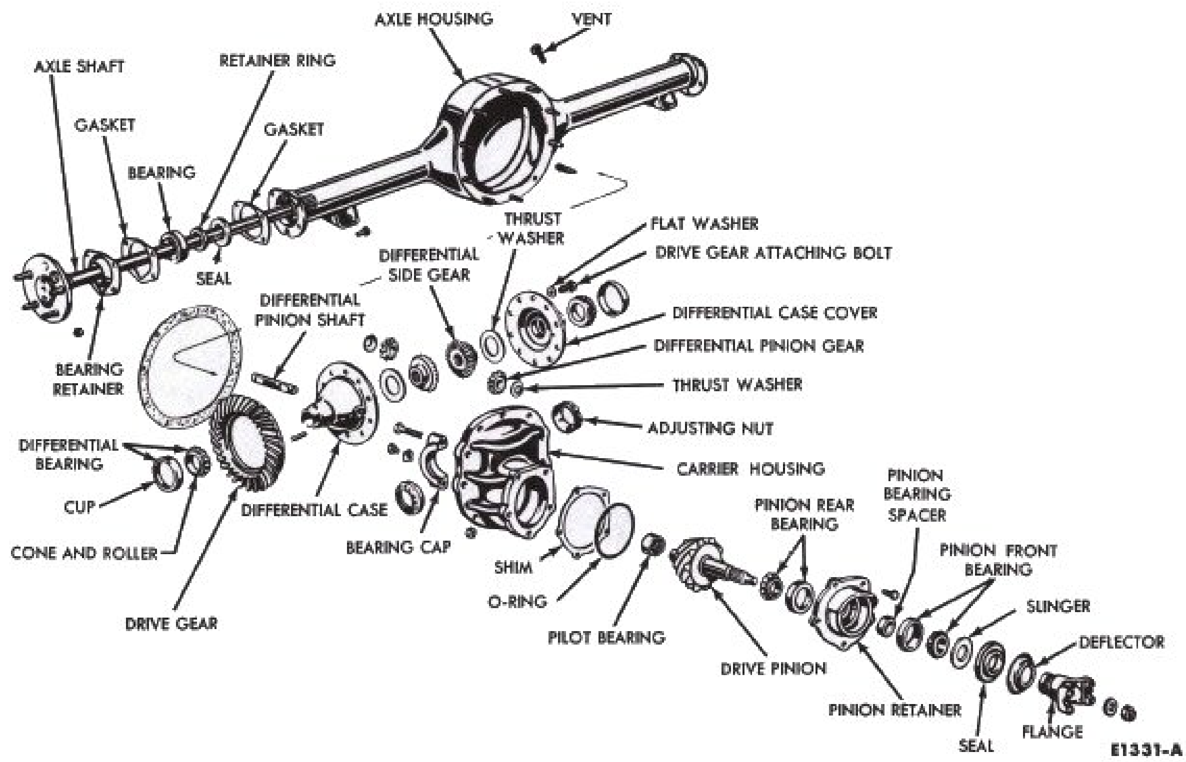


FIG. 22—Rear Axle—Disassembled

actual housing assembly shim thickness should be used with this pinion. A positive (+) number always means that a thicker shim should be installed to move the pinion gear away from the drive gear. A negative (−) number means that a thinner shim should be used to move the pinion gear closer to the drive gear. Shims are available in thicknesses ranging from 0.010 inch to 0.029 inch in steps of 0.001 inch.

A pinion gear marked "0" indicates that the gear set will obtain its correct tooth contact when located exactly at nominal dimension. This pinion, therefore, will require no change in the actual housing assembly shim pack.

A new drive gear and pinion should always be installed in an axle as a matched set (never separately). **Be sure the same matching number appears on both the drive pinion and the drive gear.** Note the number "170" in Fig. 35.

When replacing a drive gear and pinion it should be noted that the **original** factory installed shim is of the correct thickness to adjust for individual variations from nominal in both the carrier housing dimension and in the original gear set dimension; therefore, to select the correct shim thickness for the new gear set to be installed, follow these steps:

1. Measure the thickness of the **original shim** with a micrometer.

2. Note the shim adjustment number on both the old pinion and the new pinion.

3. Refer to Table 1 to determine the correct amount of shim thickness change. The amount shown in Table 1 under the old pinion shim adjustment number and in line with the new pinion number is the amount of **change** that should be made to the **original** shim thickness.

If the **original** shim pack was lost or if a new carrier housing is being installed, substitute a **nominal** 0.020-inch shim for the **original**, and follow the foregoing procedure for a trial build-up. If any further shim change is necessary, it will be indi-

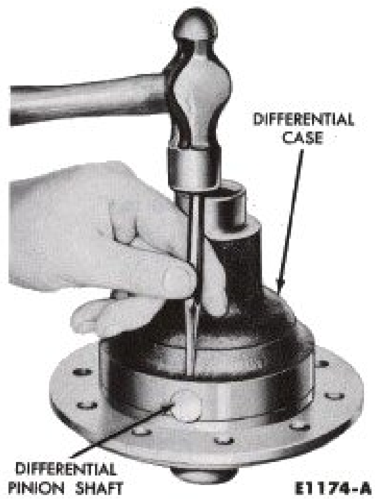


FIG. 24—Differential Pinion Shaft Retainer Removal

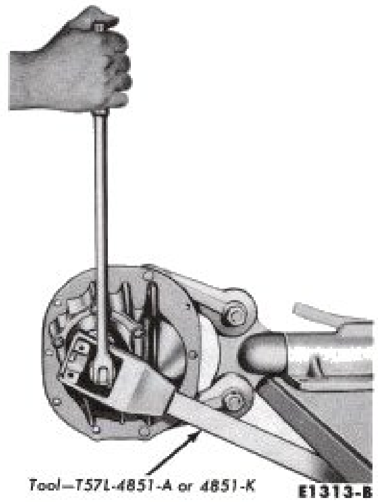


FIG. 26—Pinion Shaft Nut Removal

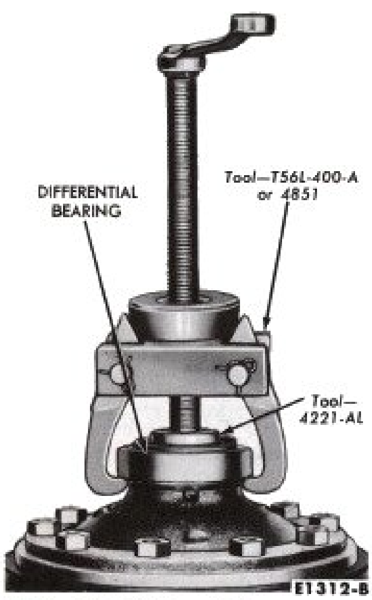


FIG. 23—Differential Bearing Removal

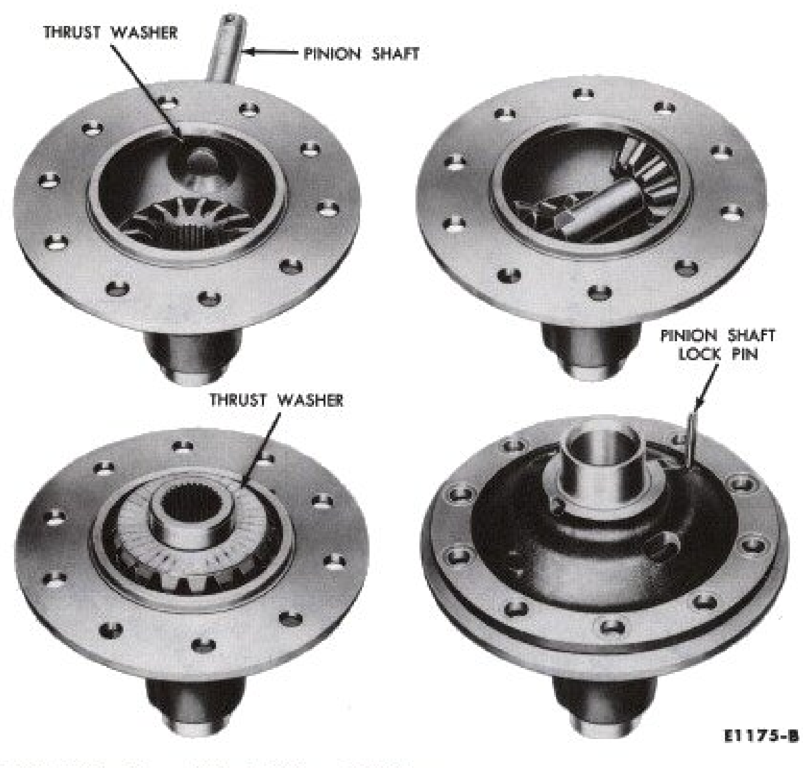


FIG. 25—Assembly of Differential Case

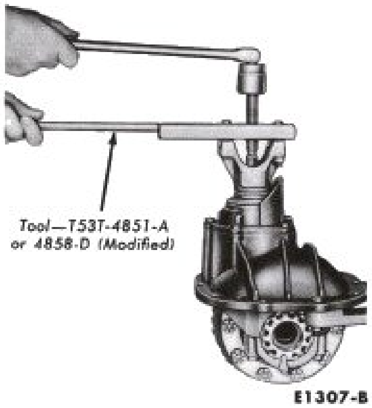


FIG. 27—U-Joint Flange Removal

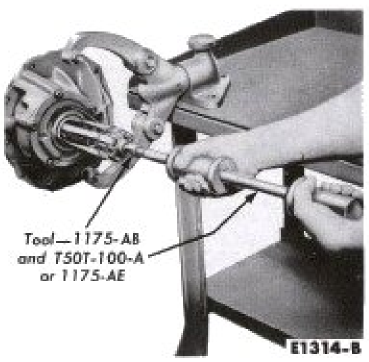


FIG. 28—Pinion Seal Removal

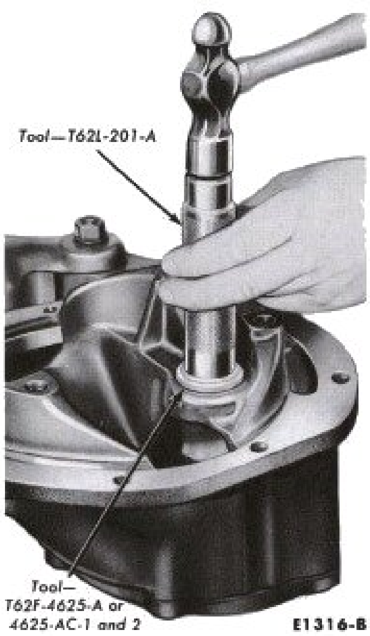


FIG. 29—Pilot Bearing Removal

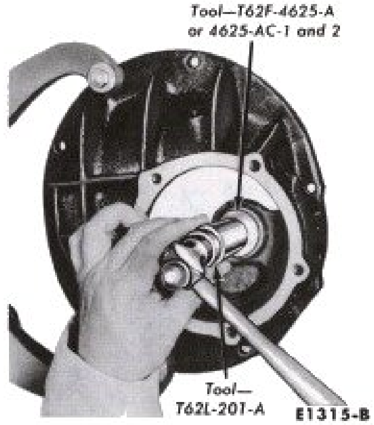


FIG. 30—Pilot Bearing Installation

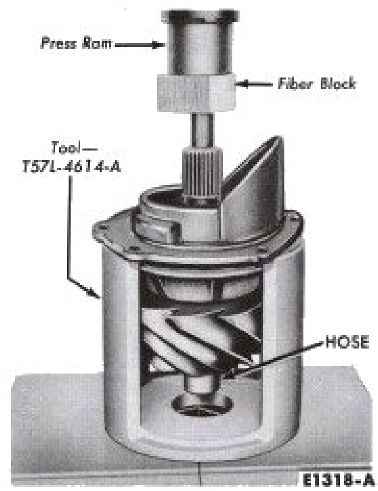


FIG. 31—Pinion Front Bearing Cone Removal

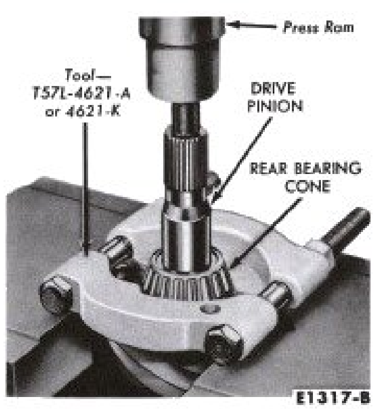


FIG. 32—Pinion Rear Bearing Cone Removal

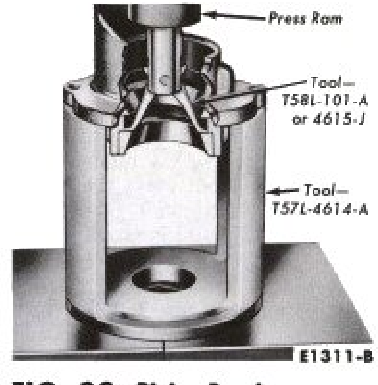


FIG. 33—Pinion Bearing Cup Removal

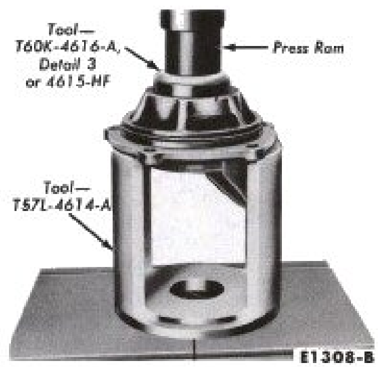


FIG. 34—Pinion Bearing Cup Installation

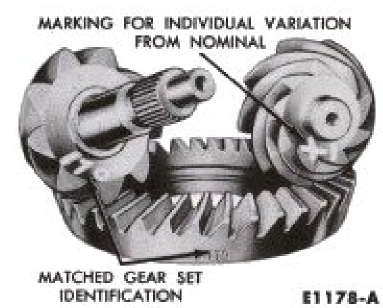


FIG. 35—Pinion and Drive Gear Markings

cated in the tooth pattern check.

Before installing the pinion, determine which type of gear set is being used. The **non-hunting** and **partial non-hunting** types can be identified by the paint "timing" marks on the gear teeth. (Part 4-1, Fig. 1).

If the gear set is of the **non-hunting** or **partial non-hunting** type, clean the teeth on both the pinion and drive gear so that the timing marks are visible. Rotate the diff-

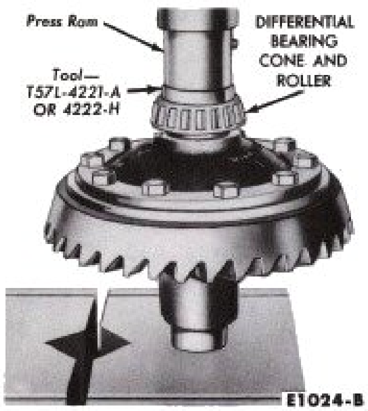


FIG. 36—Differential Bearing Installation

erential case and drive gear assembly in the carrier until the marked teeth on the drive gear are opposite the pinion entry hole. Place the assembly in the carrier so that the marked tooth on the pinion indexes between the marked teeth on the drive gear (Part 4-1, Fig. 1).

In almost every case of improper assembly (gear assembled out of time), the noise level and probability of failure will be higher than they would be with properly assembled gears.

ASSEMBLY OF DIFFERENTIAL CASE

1. Place a side gear and thrust washer in the differential case bore (Fig. 25). **Lubricate all differential parts liberally with axle lubricant during assembly.**

2. With a soft-faced hammer, drive the pinion shaft into the case only far enough to retain a pinion thrust washer and pinion gear.

3. Place the second pinion and thrust washer in position, and drive the pinion shaft into place. **Carefully line up the pinion shaft retainer holes.**

4. Place the second side gear and thrust washer in position (Fig. 25), and install the cover of the differential case. Install the retainer. A pinion or axle shaft spline can be inserted in the side gear spline to check for free rotation of the differential gears.

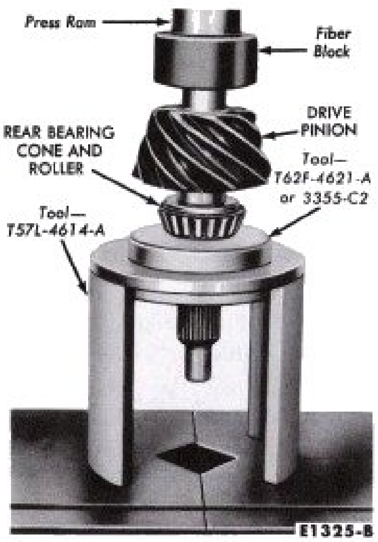


FIG. 37—Pinion Rear Bearing Cone Installation

5. Insert two 7⁄16 (N.F.) bolts two inches long through the differential flange, and thread them three or four turns into the drive gear as a guide in aligning the drive gear bolt holes. Press or tap the drive gear into position.

6. Install and tighten the drive gear bolts and washers evenly, and torque them alternately across the gear to specifications.

7. If the differential bearings have been removed, press them on as shown in Fig. 36.

ASSEMBLY AND INSTALLATION OF DRIVE PINION AND BEARING RETAINER

1. Install the drive pinion rear bearing cone and roller on the pinion

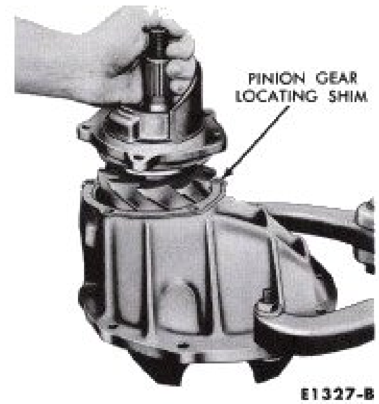


FIG. 39—Pinion and Retainer Installation

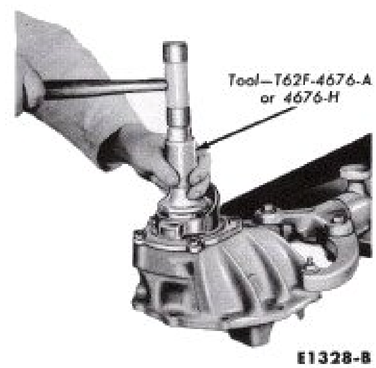


FIG. 40—Oil Seal Installation

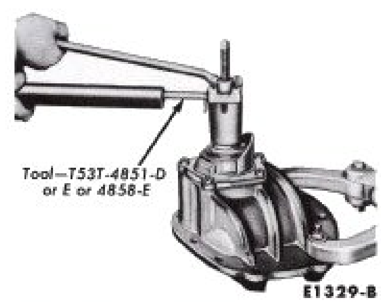


FIG. 41—U-Joint Flange Installation

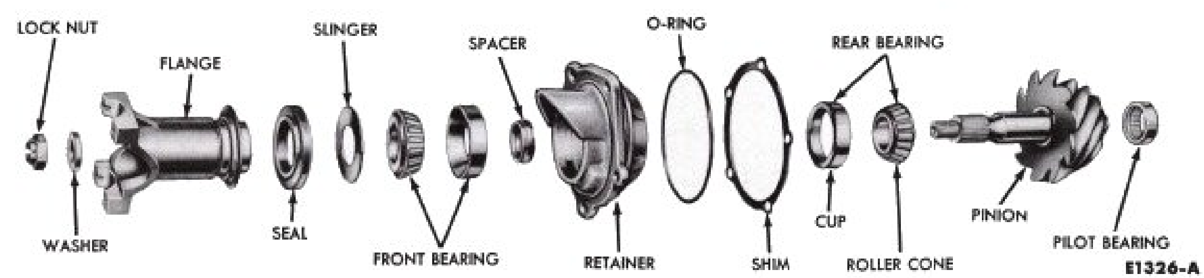


FIG. 38—Pinion and Bearing Retainer

shaft (Fig. 37). Place a new spacer on the pinion shaft (Fig. 38).

2. Place the bearing retainer on the pinion shaft, and install the front bearing cone and roller.

3. Lubricate the O-ring with axle lubricant and install it in its groove in the pinion retainer. Be careful not to twist it.

4. Place the proper shim on the carrier housing and install the pinion and retainer (Fig. 39). Always install the pinion and retainer to the drive gear carrier with the carrier out of the axle. Hold the needles in the pilot bearing until the pinion pilot has entered the pilot bearing.

5. Install the pinion retainer bolts. Torque the bolts to specifications.

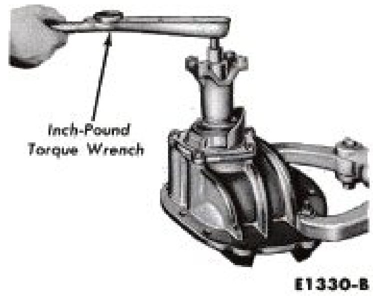


FIG. 42—Pinion Bearing Pre-Load Check

6. Place the slinger on the pinion shaft.

7. Coat the outside edge of a new oil seal with an oil resistant sealer and install it in the bearing retainer (Fig. 40). Soak new seals in SAE 10 oil for ½ hour before use.

8. Install the U-joint flange (Fig. 41). Slip on and tap with a soft-faced hammer if necessary to provide threads for starting the nut.

9. Place the flat washer over the pinion shaft and start the pinion shaft nut.

10. Hold the flange (Fig. 26) and tighten the pinion shaft nut until the torque required to turn the pinion shaft is within specifications. As the pinion shaft nut is tightened, rotate the pinion shaft frequently to allow the bearing to seat. Check the bearing pre-load as shown in (Fig. 42).

PART 4-3 SPECIFICATIONS

REAR AXLE—USED WITH SIX ENGINE

DRIVE PINION ADJUSTING SHIM THICKNESS CHANGES—INCHES

Old Pinion Marking	New Pinion Marking								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

REAR AXLE RATIOS, GEAR, AND CODE IDENTIFICATION

Code Symbol	Axle Ratio	No. of Teeth	
		Driven Gear	Pinion
3	3.10:1	31	10
J	3.50:1	35	10
2	3.89:1	35	9
4	4.00:1	36	9
5	3.20:1	32	10
1	3.56:1	32	9

REAR AXLE

Adjustments	Inches
Backlash Between Drive Gear and Pinion	0.006-0.010
Backlash Variation between Teeth	Max. 0.002
Runout of Backface of Ring Gear as Assembled	Max. 0.002
Thickness: Differential Side Gear Thrust Washers Differential Pinion Gear Thrust Washers	 0.030-0.032 0.030-0.032
Rear Bearing Cone to Pinion Gear Nominal Shim	.020
Shims Available:	0.008-0.024

LUBRICANT CAPACITY

Rear Axle	2½ Pints (Approximate)

TORQUE LIMITS

	Ft-lbs
Rear Cover Bolts	10-17
Differential Bearing Cap Screws	40-55
Differential Bearing Adjusting Nut Lock Bolts	12-20
Rear Shock Absorber to Rear Spring Clip Plate Assembly Nuts	15-25
Universal Joint Flange Axle End to Universal Joint Bearing Assembly Nuts	10-14
Drive Gear Attaching Cap Screws	40-50
Rear Axle Shaft Bearing Retaining Nuts	30-35
Spring Clip Nuts (Rear Springs to Axle Housing)	13-20
Minimum Torque Required to Tighten Pinion Flange Lock Nut to Obtain Correct Pinion Bearing Preload	140
Pinion Bearing Preload New Bearings Used Bearings	 17-27* 6-12*
Differential Bearing Preload	2-3 notch tight

*Inch-pounds

REAR AXLE USED WITH V-8 ENGINE

ADJUSTMENTS

	Inches
Backlash Between Drive Gear and Pinion	0.008-0.012
Maximum Backlash Variation Between Teeth	0.003
Maximum Runout of Backface of Ring Gear as Assembled	0.003
Thickness Differential Side Gear Thrust Washers Differential Pinion Gear Thrust Washers	 0.030-0.032 0.030-0.032
Nominal Pinion Locating Shim	0.020
Available Shims (In steps of 0.001 inch)	0.010-0.029

DRIVE GEAR AND PINION IDENTIFICATION

Ratio	Number of Teeth	
	Drive Gear	Pinion
3.00:1	39	13
3.25:1	39	12
3.50:1	35	10
3.80:1	38	10

LUBRICANT CAPACITY

Rear Axle.................................4½ Pints (Approximate)

TORQUE LIMITS

Description		Foot-Pounds
Differential Bearing Cap Screws		55-65
Differential Bearing Adjusting Nut Lock Bolts		12-20
Carrier to Housing Stud Nuts		30-40
Pinion Retainer to Carrier Cap Screws		30-40
Drive Gear Attaching Cap Screws		65-75
Rear Axle Shaft Bearing Retainer Bolts		30-40
Rear Shock Absorber to Rear Spring Clip Plate Assembly Nuts		15-22
Pinion Flange U-Bolt Nuts		12-15
Spring Clip Nuts (Rear Springs to Axle Housing)		30-45
Minimum Torque Required to Tighten Pinion Nut to Obtain Correct Pinion Bearing Preload		175*
Pinion Bearing Preload	New Bearings and New Seal	22-32 inch-pounds
	New Bearings and Used Seal	16-26 inch-pounds
	Used Bearings and New Seal	13-17 inch-pounds
	Used Bearings and Used Seal	8-12 inch-pounds
Differential Bearing Preload		2½-3 notches tight

*If this torque can not be obtained with a used spacer, install a new spacer.

DRIVE PINION ADJUSTING SHIM THICKNESS CHANGES (Inches)

New Pinion Marking	Old Pinion Marking								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

DRIVE LINE & CLUTCH

GROUP 5

PART 5-1 DRIVE LINE

1 TROUBLE DIAGNOSIS

DRIVE SHAFT TROUBLE DIAGNOSIS AND POSSIBLE CAUSES

DRIVE SHAFT VIBRATION	Undercoating or other foreign material on shaft. Universal joint U-bolts loose. Universal joints worn, or lack of lubricant. Drive shaft mis-aligned (drive line angle). Drive shaft and universal joints 180° out of phase. Broken rear spring center bolt. Broken rear spring. Rear springs not matched(sagged to one side). Drive shaft damaged (bent) or out of balance (missing balance weights).
U-JOINT NOISE	Universal joint U-bolts loose. Lack of lubrication. Worn U-joints.

2 DESCRIPTION AND OPERATION

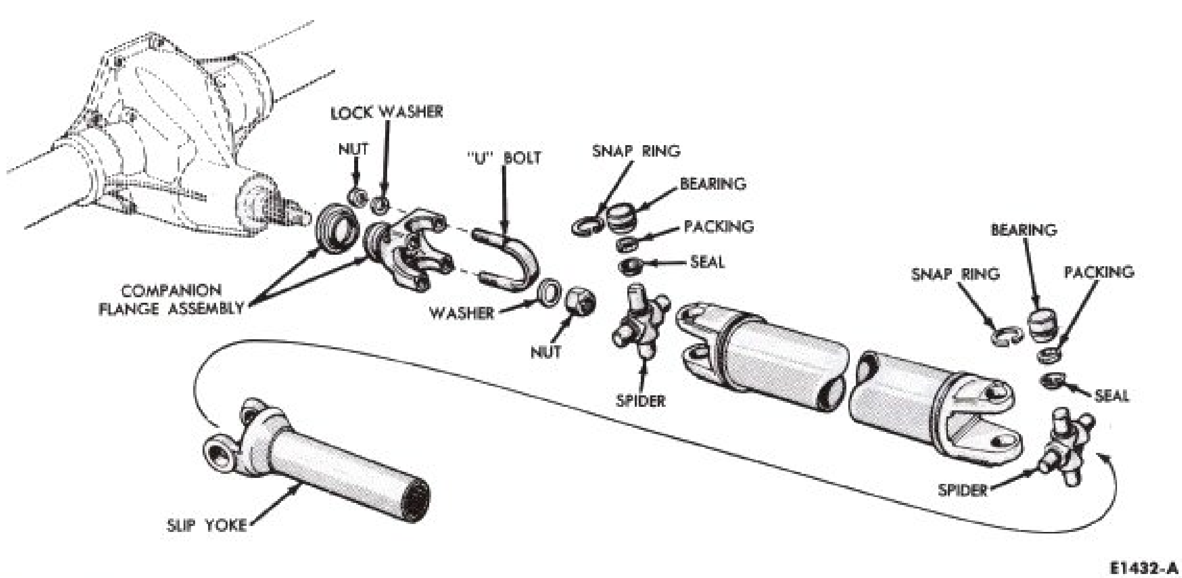


FIG. 1–Drive Line and Universal Joints Disassembled

The drive shaft is the means of transferring power from the engine to the differential in the rear axle and then to the rear wheels. The drive shaft incorporates two universal joints and slip yoke. The universal joints (Fig. 1) are provided with a threaded plug which can be removed to lubricate the universal joints when necessary. The splines in the yoke and on the transmission output shaft permit the drive shaft to move forward and rearward as the axle moves up and down.

All drive shafts are balanced. If the car is to be undercoated, cover the drive shaft and universal joints to prevent application of the undercoating material.

3 REPLACEMENT

REMOVAL

1. To maintain drive line balance, mark the relationship of the slip yoke and the drive flange on the axle with the shaft so that they may be installed in their original positions.

2. Disconnect the rear U-joint from the drive pinion flange. Pull the drive shaft toward the rear of the car until the front U-joint yoke clears the transmission extension housing and the seal.

3. Remove the snap rings which retain the bearings in the yoke and drive shaft.

4. Place the U-joint in a vise or a press.

5. Select a socket wrench with an outside diameter slightly smaller than the U-joint bearings. Select another socket wrench with an inside diameter slightly larger than the bearing outside diameter.

6. Place the socket wrenches at opposite bearings so that the smaller socket wrench becomes a bearing driver and the larger one becomes a bearing receiver, when the vise jaws come together (Fig. 2).

7. Close the vise jaws until the spider contacts the yoke or drive shaft. Remove the drive shaft from the vise. Remove the one bearing with channel lock pliers.

8. Reverse the sockets and press the opposite bearing outward until the spider contacts the yoke or drive shaft. Remove the bearing with channel lock pliers.

9. Remove the spider from the shaft or yoke.

10. Remove the remaining two bearings in the same manner.

11. If new U-joint bearings are being installed, **be sure the new bearings have adequate grease.**

12. Position the spider in the yoke. Press a bearing into the bore and onto the spider. Press another bearing in the opposite bore of the yoke and onto the spider.

13. Install the snap ring on each bearing.

14. Install the spider and bearings in the drive shaft in the same manner as in the yoke.

15. Use the same procedure to remove and replace the rear U-joint spider and bearings.

Check the joint for freedom of movement. If a bind has resulted from misalignment during the foregoing procedures, tap the ears of the drive shaft sharply to relieve the bind. Do not install the drive shaft unless the universal joints are free of bind.

16. If the rubber seal installed on the end of the transmission extension housing is damaged in any manner, install a new seal.

17. On a manual-shift transmission, lubricate the yoke spline with conventional transmission lubricant (Group 21). On an automatic transmission, lubricate the yoke spline only with special spline lubricant (Group 21). This spline is sealed so that the transmission fluid does not "wash" away the spline lubricant (Fig. 3). Install the yoke on the transmission output shaft.

18. Install the U-bolts and nuts that attach the U-joint to the drive pinion flange.

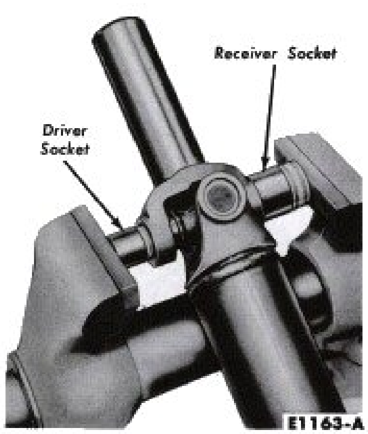


FIG. 2—Removing U-Joint

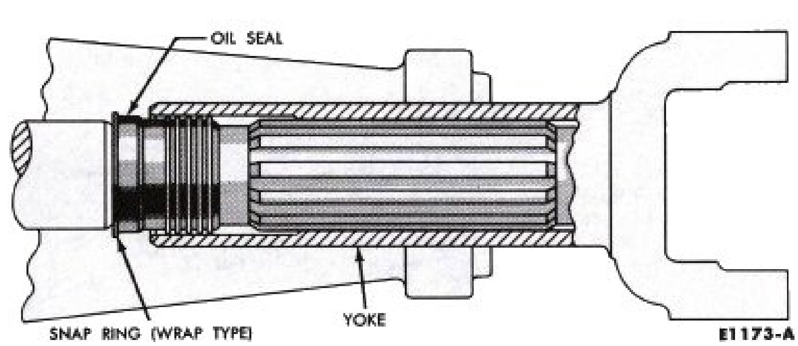


FIG. 3—Output Shaft Spline Seal

PART 5-2 GENERAL CLUTCH SERVICE

1 DIAGNOSIS AND TESTING

TROUBLE SYMPTOMS AND POSSIBLE CAUSES

CLUTCH NOISY WITH ENGINE STOPPED	Pressure plate lugs rubbing against cover. Clutch linkage improperly adjusted or inadequately lubricated.	Clutch assist spring clunking. Release bearing hub burred and dragging on transmission bearing retainer.
CLUTCH NOISY WHEN PEDAL FREE TRAVEL IS TAKEN OUT, ENGINE RUNNING	Release bearing failure due to: Improper travel adjustment. Bearing cocked on hub.	Release lever out of plane. Flywheel housing misalignment. Excessive crankshaft end play.
CLUTCH NOISY WHEN PEDAL IS THREE-QUARTERS TO FULLY DEPRESSED, ENGINE RUNNING	Pressure plate lugs rubbing against window openings in cover.	Release bearing failure. Loose and worn pilot bearing.
CLUTCH SLIPS OR CHATTERS	Incorrect pedal free travel. Grease or oil on clutch facings from: Release bearing.	Release lever. Pilot bearing. Transmission. Pressure plate fingers binding.
CLUTCH VIBRATION	Improper or defective clutch disc. Release bearing out of plane.	Flywheel housing misalignment. Pressure plate fingers binding.
THUD	Excessive engine crankshaft end play.	
GEAR CLASH OR POOR RELEASE	Incorrect pedal free travel. Disc binding on transmission input shaft.	Excessive disc runout. Flywheel housing misalignment. Excessive engine idle speed.
CLUTCH PEDAL SCRUBBING	Release lever cocked. Pedal push rod rubbing on firewall felt and insulator. Release lever pivot knife edge rough. Pedal shaft binding at support bracket.	Pressure plate finger rubbing internally. Burrs on clutch pedal or clutch assist spring retainer. Release bearing hub scrubbing on input shaft bearing retainer.

2 FLYWHEEL HOUSING ALIGNMENT

Alignment of the flywheel housing bore and rear face with the engine should be checked as a possible cause of any of the following troubles: excessive transmission gear wear, transmission jumping out of gear, especially third gear, drive line vibration, excessive pilot bushing wear, noisy release bearing, or excessive clutch spin time.

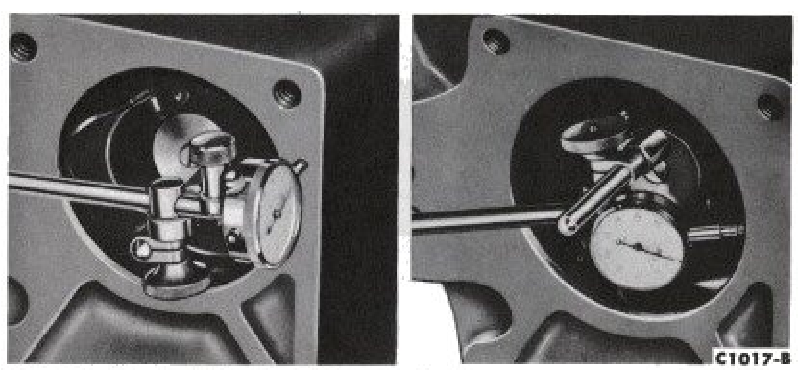


FIG. 1—Flywheel Housing Alignment Check

INSPECTION

With the clutch release bearing removed, install the indicator pilot tool shown in Fig. 1. Clean the faces

C1467-A

FIG. 2—Dia-L-igner Gauge

of the flywheel housing bolt bosses, and remove all burrs, nicks, and paint from the mounting face of the housing.

Install the dial indicator on the pilot and adjust the holder so the button will contact a circumference just inside of the transmission mounting holes. Remove the flywheel housing cover and pull the flywheel outward or push it inward to remove crankshaft end play. Set the dial indicator face to read zero.

Remove the spark plugs to alleviate compression. Pull the engine crankshaft through one revolution. The crankshaft must be held all the way out or all the way in. Note the indicator reading and mark the maximum point of runout on the face of the housing as detailed in steps 1 and 2 of the Dia-L-igner instructions (Fig. 2).

Position the dial indicator to check bore alignment (Fig. 1). The bore must be clean and free of burrs, nicks and paint.

Pull the crankshaft through one revolution. Note the indicator reading and mark the maximum point of runout on the face of the housing as detailed in steps 3 and 4 of the Dia-L-igner instructions (Fig. 2).

After completing the above inspection, install the spark plugs and the flywheel housing cover.

CORRECTION

ENGINE IN CAR

Since any change in face alignment will change bore alignment, it may be possible to correct bore alignment by changing face alignment. Face alignment can be changed by shimming between the flywheel housing and engine. Fig. 3 shows the type of shim which can be fabricated.

Not more than 0.010 inch thickness shims may be used between the flywheel housing and engine. If a 0.010-inch shim will not bring face and bore alignment within limits, replace the flywheel housing.

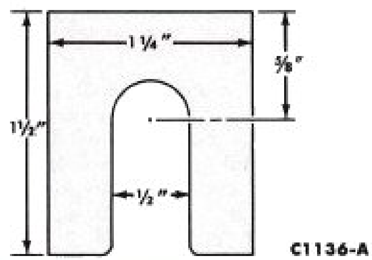


FIG. 3—Fabricated Flywheel Housing Shim

The shim required is one half the maximum (−) indicator reading, and should be located at the point of maximum minus (−) indicator reading.

If both the bore and face alignment are out of limits, shim between the flywheel housing and engine to bring face alignment within limits. Check the bore alignment.

If the bore alignment is out of limits and the face alignment is within limits, shim the flywheel housing to the limit of face misalignment and check the bore alignment. If it is not within limits, replace the housing.

ENGINE OUT OF CAR

The same procedure to correct alignment may be used with the engine out of the car or in the car, up to the point of replacing the flywheel housing. If the bore alignment cannot be brought within limits by shimming, follow this procedure:

1. Remove the flywheel housing from the engine and remove the dowel pins. Install the flywheel housing and tighten the attaching bolts.
2. Install the dial indicator (Fig. 1). Check the face alignment, and shim as required to bring face alignment within limits.
3. Position the indicator to check the bore alignment. If the bore alignment is not within limits, reduce the tension on the flywheel housing attaching bolts so that the housing can be moved by striking it with a lead hammer or a block of wood and a steel hammer.
4. The lateral alignment should be brought within limits so that an indicator reading is within limits between the 9 o'clock and 3 o'clock positions on the bore circle. When the lateral alignment is within limits, the housing usually can be moved straight up or down without disturbing the lateral alignment. When alignment is within limits, torque the housing bolts and recheck bore alignment.
5. If the flywheel housing cannot be moved enough to bring the alignment within limits, mark the holes restricting movement, and then remove the housing and drill the marked bolt holes 1/32 inch larger.
6. When the flywheel housing bore alignment is within limits and the attaching bolts are at normal torque, hand ream the dowel pin holes 1/32 inch larger. Use a straight reamer and ream from the flywheel housing side. Oversize dowel pins can be made from drill rod stock.
7. Remove the flywheel housing and then install the oversize dowel pins in the cylinder block. Complete the assembly in the usual way.

3 CLEANING AND INSPECTION

RELEASE BEARING

Wipe all oil and dirt off the release bearing. **The bearing is prelubricated and should not be cleaned with solvent.**

Inspect the bearing retainer for loose spring clips and rivets.

Inspect the release bearing assembly for burrs which may cause the assembly to drag on the transmission bearing retainer. Any such burrs should be cleaned up with fine crocus cloth. If burrs are found, inspect the transmission input shaft bearing retainer for evidence of scoring. Any scoring should be polished out with crocus cloth. Coat the bearing retainer with a thin film of lithium-base grease (COAZ-19584-A).

Hold the bearing inner race and rotate the outer race while applying pressure to it. If the bearing rotation is rough or noisy, replace the bearing.

Most release bearing failures are caused by improper clutch pedal adjustments. If the clutch linkage does not have enough free travel, the release bearing will constantly touch the release fingers and will spin whenever the engine is running.

When installing a release bearing, use the tool shown in Fig. 4.

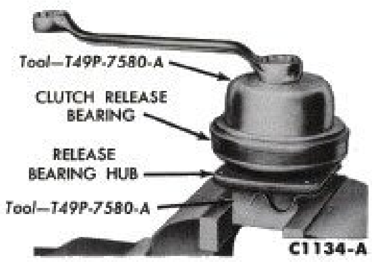


FIG. 4—Installing Clutch Release Bearing

Release bearing failure can be caused by the release lever contact points being out of plane. Check the wear on the release bearing assembly where the release lever contacts it.

If one side of the assembly shows more wear than the other, the release lever is bent out of plane, or is not centering on the bracket on the flywheel housing.

Misalignment between the engine and transmission can cause release bearing failure. Other symptoms of misalignment are: transmission jumping out of gear, especially third gear, drive line vibration; excessive wear in the pilot bushing, excessive clutch disc spin time resulting in gear clash, and excessive transmission gear wear.

PRESSURE PLATE AND COVER

Inspect the surface of the pressure plate for burn marks, scores, or ridges. Generally, pressure plate resurfacing is not recommended. However, minor burn marks, scores, or ridges may be removed. During the resurfacing process, the flatness of the pressure plate must be maintained. If the pressure plate is badly heat-checked or deeply scored, replace the pressure plate and cover assembly. Clean the pressure plate and flywheel surfaces with a suitable solvent to be sure the surfaces are free from any oil film. **Do not use cleaners with petroleum base, and do not immerse the pressure plate in the solvent.**

Place the plate on the floor, being careful not to score or scratch the surface. Force each individual finger down, then release it quickly. If the finger does not return quickly, a binding condition is indicated, and the pressure plate should be replaced.

The pressure plate should be lubricated with a lithium-base grease between the driving lugs and the edges of the pressure plate openings as shown in Fig. 5. Depress the pressure plate fingers fully, apply the lubricant, and then move the fingers up and down until the lubricant is worked in. **Do not apply excessive lubricant.**

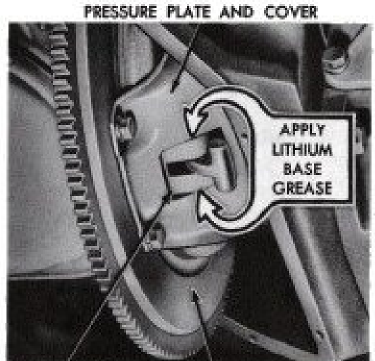


FIG. 5—Pressure Plate Lubrication Point

CLUTCH DISC

Inspect the clutch disc facings for oil or grease. **Eliminate the source of any oil or grease before replacing the disc.** An excessive amount of grease in the pilot bushing or release bearing hub will find its way to the disc facings. Too much lubricant in the transmission or a plugged transmission vent will force the transmission lubricant out the input shaft and onto the disc facings.

Inspect the clutch disc for worn or loose facings. Check the disc for distortion and for loose rivets at the hub. Check for broken springs. **Springs loose enough to rattle will not cause noise when the car is operating.** Replace the disc assembly if any of these defects are present. **Be especially careful when installing a new disc to avoid dropping it or contaminating it with oil or grease.**

PILOT BUSHING

Check the fit of the clutch pilot bushing in the bore of the crankshaft.

The bushing is pressed into the crankshaft and should not be loose. Inspect the inner surface of the bushing for wear or a bell-mouthed condition. If the bushing is worn or damaged, replace the bushing with a new service bearing. Refer to the applicable engine for the replacement procedure.

PART 5-3 CLUTCH

1 DESCRIPTION

The clutch is of the centrifugal single dry disc type and consists of the clutch disc, pressure plate, and the clutch release bearing (Fig. 1). The clutch is actuated by a clutch pedal and a series of mechanical linkage.

2 IN-CAR ADJUSTMENTS AND REPAIRS

CLUTCH PEDAL ADJUSTMENT

Adjust the clutch pedal whenever the clutch does not disengage or engage properly, or when new clutch parts are installed. Both the total travel and the free travel of the pedal should be adjusted. **Improper adjustment of the clutch pedal is one of the most frequent causes of clutch failure and can be a contributing factor in some transmission failures.**

1. Measure the total travel of the pedal (Fig. 2). If the travel is not within specifications, move the clutch pedal bumper and the bracket up or down until the travel is within specified limits. **Always check and adjust total travel before checking free travel.**

2. With the clutch pedal against its bumper (pedal released), measure the overall length of the spring (Fig. 4). The spring length should be 10¼ inches.

3. With the engine idling, depress the pedal just enough to take up the free travel and note the reading on the tape (Fig. 2). The difference between this reading and the reading where the pedal is released is the clutch pedal free travel. If the free travel is not within specifications, adjust the clutch pedal to equalizer rod (Fig. 3). To increase the free travel, loosen the rearward adjusting nut and tighten the forward nut. To reduce the free travel, loosen the forward nut and tighten the rearward nut. **Both nuts must be tightened against the trunnion after making the adjustment.**

4. As a final check, measure the pedal free travel with the transmission in neutral and the engine running at about 3000 rpm. If the free travel at this speed is not ½ inch, readjust the clutch pedal to equalizer rod to obtain the specified free travel. Otherwise, the release fingers may contact the release bearing con-

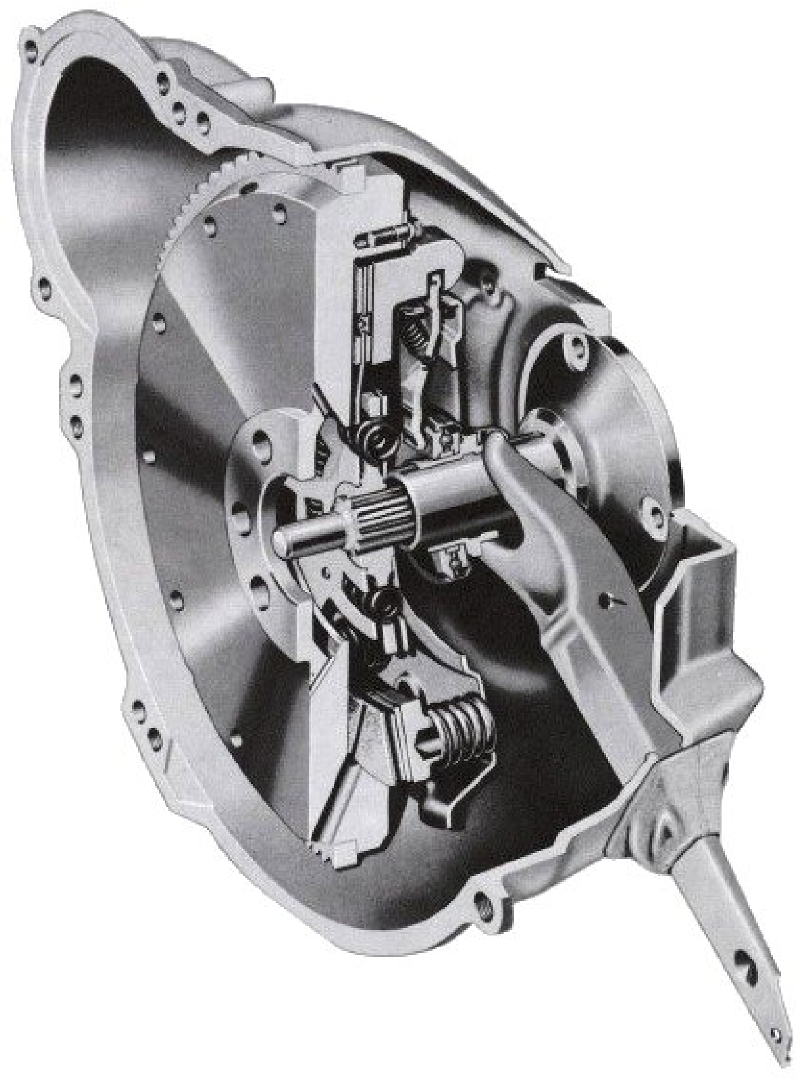


FIG. 1—Typical Clutch

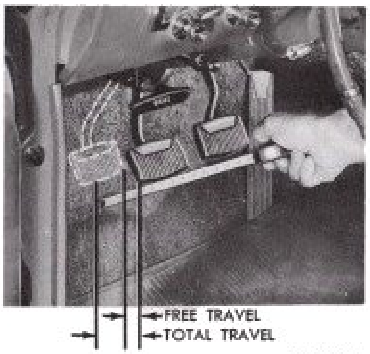


FIG. 2—Clutch Pedal Travel

tinuously, resulting in premature bearing and clutch failure. **Free travel must be exactly to specification.**

CLUTCH PEDAL AND/OR BUSHING REPLACEMENT REMOVAL

REMOVAL

1. Remove the nut from the retainer on the upper end of the assist spring. Then remove the spring and retainer from the pedal and pedal support (Fig. 4).

2. Disconnect the clutch pedal to equalizer rod from the pedal.

3. Remove the retaining clip and spring washer from the clutch pedal shaft. Then remove the shaft, bushings, and pedal from the support.

4. Remove the bushings from the pedal shaft, and transfer the pedal pad.

INSTALLATION

1. After lubricating the clutch pedal shaft bushings, position them on the shaft. Then position the shaft and pedal in the pedal support.

2. Install the spring washer, and retaining clip on the pedal shaft.

3. Connect the clutch pedal to equalizer rod to the pedal.

4. After positioning the assist spring eye insulators, depress the clutch pedal and install the assist spring and retainer.

5. Adjust the clutch pedal travel.

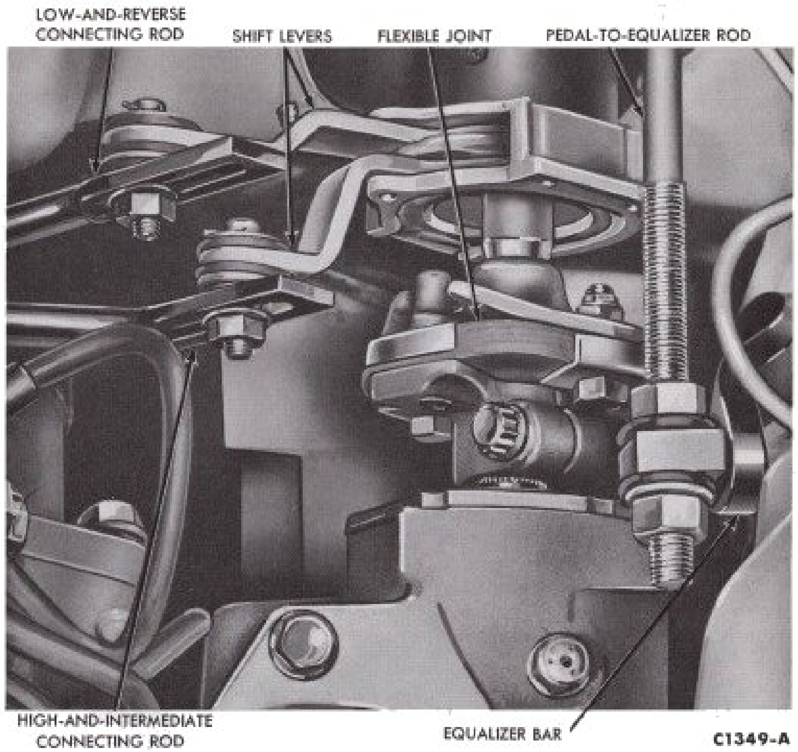


FIG. 3—Clutch Pedal Travel Adjustment—Typical

EQUALIZER BAR AND/OR BUSHING REPLACEMENT

1. Disconnect the pedal to equalizer rod at the pedal, and then disconnect this rod and the interlock shift rod from the equalizer bar (Fig. 4).

2. Raise the car and disconnect the release lever retracting spring at the lever.

3. Remove the equalizer bar outer bracket and the bushing.

4. Remove the release rod from the equalizer bar, and then remove the equalizer bar. Remove the bushings and spacers from the inner mounting stud.

5. Position the equalizer bar, spacers, inner bushing, and retainers on the inner stud.

6. After positioning the outer bushing, install the outer bracket (with the equalizer bar in place).

7. Connect the release rod and the release lever retracting spring.

8. After lowering the car, install the pedal to equalizer rod.

9. Adjust the clutch pedal free travel and the interlock.

3 REMOVAL AND INSTALLATION

CLUTCH REMOVAL

1. Raise the car on a hoist.

2. Disconnect the drive shaft from the rear U-joint flange. Then slide the drive shaft off the transmission output shaft. Insert tool T60K-7657-B (Ford) or 7657-C (Mercury) over the output shaft and into the extension housing oil seal.

3. Disconnect the speedometer cable from the extension housing.

4. Disconnect the gear shift rods from the transmission levers.

5. Disconnect the parking brake

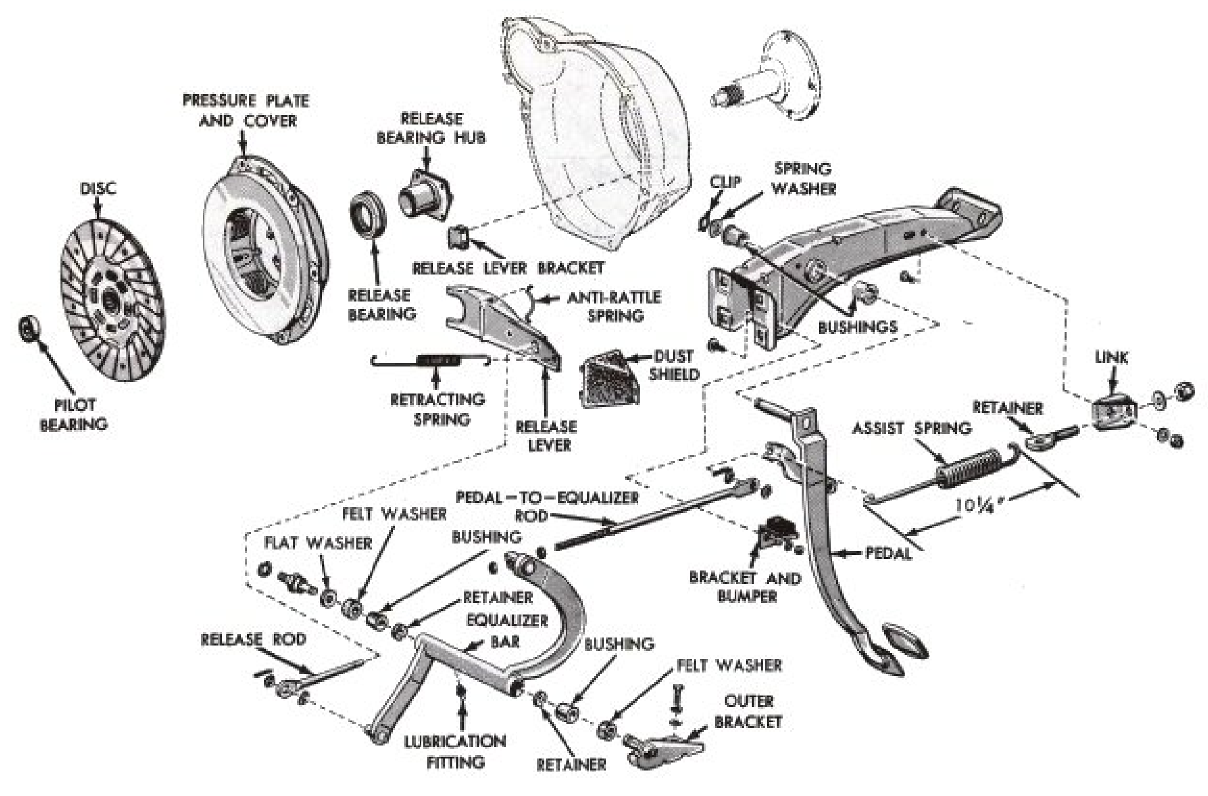


FIG. 4—Clutch and Linkage Disassembled

cable, and support the rear of the engine with a transmission jack.

6. Remove the bolts that attach the extension housing to the leaf spring.

7. Remove the bolts that attach the transmission to the flywheel housing.

8. Move the transmission rearward until the input shaft clears the flywheel housing.

9. Remove the flywheel housing cover.

10. Remove the release lever retracting spring. Then slide the release bearing and hub off the release lever.

11. Loosen the six pressure plate cover attaching bolts evenly to release the spring tension. **If the same pressure plate and cover is to be installed after the clutch is overhauled, mark the cover and flywheel so that the pressure plate can be installed in the same position.**

12. Remove the cover and pressure plate and the clutch disc through the opening at the bottom of the flywheel housing.

13. Remove the clutch release lever.

CLUTCH INSTALLATION

1. Install the clutch release lever.

2. Place the clutch disc, and pressure plate and cover assembly in position on the flywheel. Start the cover attaching bolts to hold the pieces in place but do not tighten them. **Avoid dropping the parts or contaminating them with oil or grease.**

3. Align the clutch disc with the tool shown in Fig. 5 and torque the six pressure plate cover attaching bolts evenly to specification. Then remove the tool.

4. Place the release bearing and hub on the release lever. Coat the bearing retainer inside diameter with a light film of lithium-soap type grease. **Do not lubricate the bearing hub.**

5. The mounting surfaces of the transmission and the flywheel housing must be free of dirt, paint, and burrs. Install two guide pins in the flywheel housing lower moutning bolt holes. Move the transmission forward on the guide pins until it is tightly positioned against the flywheel housing.

6. Install the two upper mounting bolts. Then remove the guide pins and install the two lower mounting bolts. Torque all bolts to specification.

7. Install the bolts that attach the extension housing to the leaf spring.

8. Remove the transmission jack and connect the parking brake cable.

9. Connect the gear shift rods to the transmission levers, and adjust the linkage.

10. Connect the release lever retracting spring.

11. Remove the tool from the transmission output shaft, and install the drive shaft.

12. Adjust the clutch pedal travel.

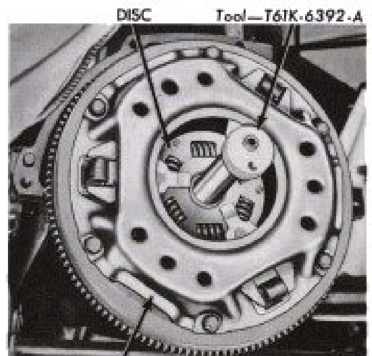


FIG. 5—Installing Clutch Disc

PART 5-4 SPECIFICATIONS

CLUTCH AND MANUAL-SHIFT TRANSMISSIONS

CLUTCH ADJUSTMENTS

	Inches
Clutch Pedal Free Travel (Engine Idling) ± $\frac{1}{16}$	$1\frac{1}{16}$-$1\frac{1}{8}$
Clutch Pedal Total Travel ± $\frac{1}{8}$	$6\frac{1}{4}$
Assist Spring Length Installed (end of spring hooks)	$10\frac{1}{4}$
Maximum Indicator Reading of Concentricity —Flywheel Housing Bore to Crankshaft Centerline	0.010
Maximum Indicator Reading of Face Squareness —Flywheel Housing Mounting Face to Crankshaft Centerline	0.007

TORQUE SPECIFICATIONS

	Foot Pounds
Lower Access Clutch Cover Plate to Flywheel Housing Bolts	17-20
Flywheel Housing to Block Bolts	40-50
Pressure Plate and Cover Plate Assembly Retaining Bolts	23-28
Transmission Extension Housing to Case Bolts	37-42
Clutch Release Equalizer Frame Bracket Bolts	25-30
Input Shaft Bearing Retainer to Transmission Case Bolts	12-15
Transmission Assembly to Flywheel Housing Bolts	37-42
Gear Shift Housing Assembly to Transmission Case Bolts	12-15
Gear Shift Control Levers to Cam and Shaft Assembly Nuts	12-15
#3 Crossmember to Support Bracket Bolts	45-50
Engine Rear Support to Transmission Case Bolts	40-45

CLUTCH IDENTIFICATION

Engine Cubic Inch Displacement	Pressure Plate			Disc	
	Diameter (Inches)	Number of Springs	Color Identification Paint Daub	Number of Springs	Spring Color
144-1V 170-1V	$8\frac{1}{2}$	6	Pressure Plate—Blue Cover Plate—Blue	3 3	Green No Color
260-2V	10	9	Pressure Plate—Gray Cover Plate—Gray	6 6	Orange—Small Orange—Large
289-2V	$10\frac{3}{8}$	9	Pressure Plate—White Cover Plate—Pink	6 6	Orange—Small Orange—Large

MANUAL SHIFT TRANSMISSIONS — GROUP 6

PART 6-1 GENERAL TRANSMISSION SERVICE

1 DIAGNOSIS AND TESTING

DIAGNOSIS GUIDE

NOISY IN FIRST THROUGH THIRD SPEEDS—FOUR-SPEED ONLY	Gear relative to pertinent speed involved worn or damaged. Countershaft gear worn or damaged. Countershaft gear bearings worn or damaged. Synchronizers worn or damaged.
NOISY IN ALL SPEEDS	Low lubricant level. Incorrect lubricant. Countershaft gear or bearings worn or damaged. Input shaft bearing worn or damaged. Transmission misaligned or loose.
NOISY IN HIGH GEAR—DIRECT	Synchronizers worn or broken. Input shaft bearing or gear worn or damaged. Output shaft bearing worn or damaged.
NOISY IN REVERSE	Reverse idler or shaft worn or damaged. Reverse sliding gear worn or broken. Shift linkage improperly adjusted. Bent, damaged, or loose shift linkage. Shift levers, shafts, or forks worn.
HARD SHIFTING	Clutch improperly adjusted. Clutch parts worn or damaged. Shift linkage out of adjustment. Bent, damaged, or loose shift linkage. Shift levers, shafts, or forks worn. Incorrect lubricant. Synchronizers worn or broken.

CONTINUED ON NEXT PAGE

DIAGNOISIS GUIDE (Continued)

JUMPING OUT OF GEAR	Worn or broken high gear synchronizer. Worn clutch teeth on input shaft and/or worn clutch teeth on synchonizer sleeve. Bent or worn shift fork, lever and/or shaft. Shift linkage out of adjustment, worn or loose. Insufficient spring tension of rail detent springs. Misalignment or loose transmission case and/or clutch housing.	Worn input shaft pilot bearing. Bent output shaft. End play in input shaft (bearing retainer loose or broken, loose or worn bearings on input and output shafts). Clutch teeth not engaging completely. Not enough over-shift travel in column. Shift cover loose or gasket damaged—four speed only.
STICKING IN GEAR	Clutch not releasing fully. Burred or battered teeth on synchonizer sleeve and/or input shaft. Frozen synchronizing blocking ring on input shaft gear cone. Stuck shift plunger.	Lack of lubrication. Improper lubrication. Corroded transmission levers (shaft). Defective (tight) input shaft pilot bearing.
LUBRICANT LEAKS	Excessive lubricant. Incorrect lubricant. Vent plugged. Input shaft bearing retainer loose, cracked or gasket damaged. Shift cover loose or gasket damaged (four-speed only).	Worn shifter shaft seals. Shift cover bolts not sealed (four-speed only). Worn or damaged extension housing seal. Countershaft loose in case bores.
GEARS SPINNING WHEN SHIFTING INTO GEAR FROM NEUTRAL	Clutch not fully releasing. Binding input shaft pilot bearing.	Synchronizers not functioning.
REVERSE GEAR CLASH	Transmission gears can be made to clash by shifting into reverse gear too quickly after the clutch pedal is depressed, even though the clutch is in perfect working order. Sufficient time **MUST** be allowed before shifting into reverse gear. If gear clash continues after allowing proper time	for the clutch driven plate parts to stop, check the clutch adjustments to specified limits. Also, make sure that the engine idle speed is to specification. Gear clash also may be caused by a dragging clutch plate (plate distorted, or input shaft pilot bearing tight).

2 COMMON ADJUSTMENTS AND REPAIRS

REAR SEAL REPLACEMENT

1. Remove the driveshaft.
2. Remove the seal from the extension housing with the tool shown in Fig. 1.
3. Install the new seal in the extension housing with the tool shown in Fig. 2.
4. Install the driveshaft.

REAR BUSHING AND SEAL REPLACEMENT

1. Remove the driveshaft from the car.
2. Insert the tool shown in Fig. 3

REAR BUSHING AND SEAL REPLACEMENT—(Cont'd)

into the extension housing until it grips the front side of the bushing.

3. Turn the screw clockwise until the seal and the bushing are free of the housing.

4. Drive a new bushing into the extension housing with the tool shown in Fig. 4.

5. Install a new seal in the housing as shown in Fig. 2.

6. Install the driveshaft.

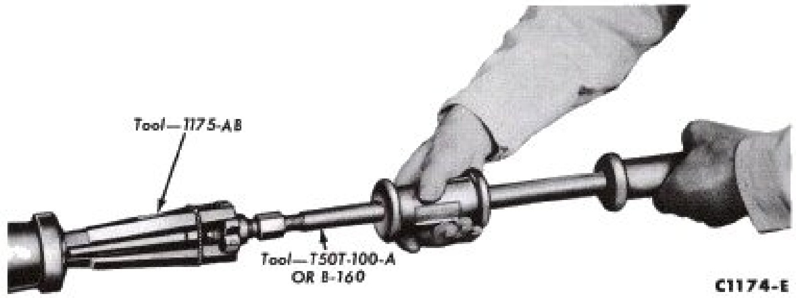


FIG. 1—Removing Extension Housing Seal

FIG. 2—Installing Extension Housing Seal

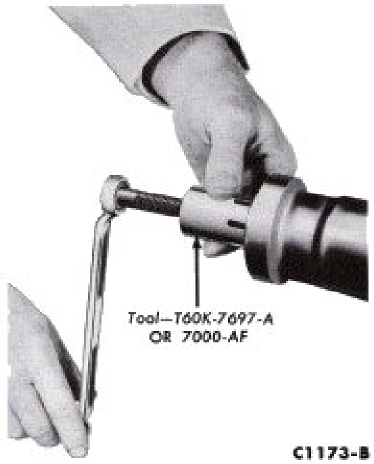


FIG. 3—Removing Extension Housing Bushing and Seal

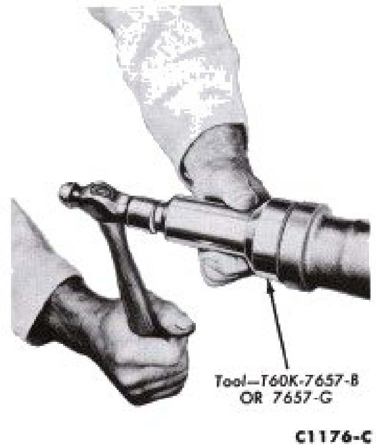


FIG. 4—Installing Extension Housing Bushing

3 CLEANING AND INSPECTION

CLEANING

1. Wash all parts, except the ball bearings, in a suitable cleaning solvent. Brush or scrape all foreign matter from the parts. Be careful not to damage any parts with the scraper. Dry all parts with compressed air.

2. Rotate the ball bearings in a cleaning solvent until all lubricant is removed. Hold the bearing assembly to prevent it from rotating, and dry it with compressed air.

3. Lubricate the bearings with approved transmission lubricant and wrap them in a clean, lint-free cloth or paper until ready for use.

INSPECTION

1. Replace a case that is cracked, or has worn or damaged bearing bores. Repair damaged threads.

2. Remove any burrs from the front and rear mounting surfaces which could cause transmission misalignment.

3. Inspect all gears for excessive wear or tooth damage. If either condition is present, replace the defective parts.

4. If the bushing in the reverse idler gear is worn, a new gear and bushing must be installed.

5. Inspect the input and the output shaft for excessive wear, and spline or tooth damage. If one of these conditions is present, replace the shaft.

6. Inspect the bearings for cracked races, and the balls and rollers for looseness, wear, end play or other damage. Replace the bearings if these conditions exist.

7. Install the countershaft gear in the transmission case. Check the end play between the countershaft gear and the thrust washers of the transmission case with a feeler gauge (Fig. 5). If the end play exceeds specification, replace the thrust washers. If the end play is within specifications, the countershaft should be removed and the countershaft gear and the dummy shaft be left in the bottom of the case until the transmission is assembled.

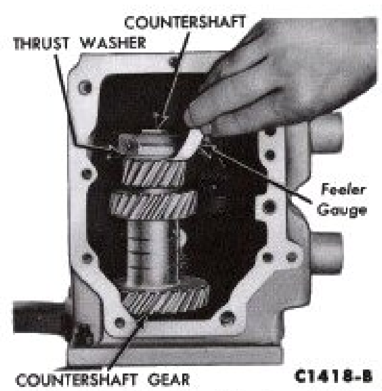


FIG. 5—Checking Countershaft Gear End Play (Typical)

8. Inspect the bushing and seal in the extension housing. If required, they may be removed and installed as detailed in Section 2.

PART 6-2 MODEL 2.77 THREE-SPEED TRANSMISSION

1 DESCRIPTION AND OPERATION

DESCRIPTION

The 2.77 C.D. three-speed transmission is used in all models with a 144 or 170 C.I.D. engine. The designation 2.77 C.D. is the actual distance between the centerline of the countershaft and the centerline of the input shaft.

An identification plate (Fig. 1) is attached to the upper right extension housing attaching bolt.

A synchronizer is provided for shifting to second and third speeds. Shifts to first and reverse speeds are accomplished with a sliding gear.

Ball bearings support the input shaft and gear and the center of the output shaft (Fig. 2). Needle bearings in the input shaft bore support the front of the output shaft. The countershaft gear (cluster gear) also runs on 2 rows of needle bearings. A bronze bushing is used in the reverse idler gear.

A bushing located at the rear of the extension housing supports the rear of the output shaft. The synchronizer and the blocking rings are the conventional tapered ring and straight clutch gear type (Fig. 2).

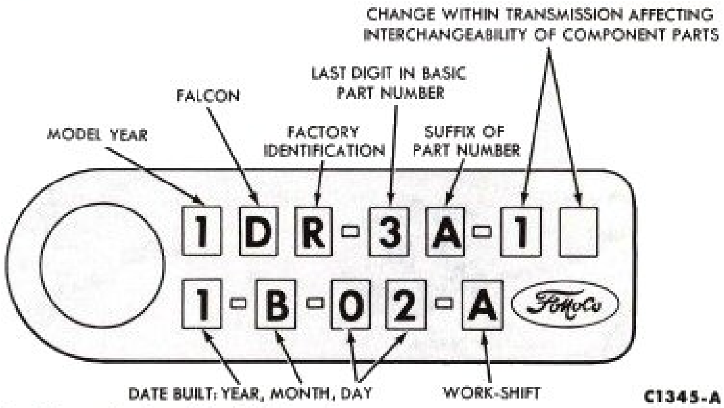


FIG. 1—Transmission Identification Tag

OPERATION

When first gear is selected, the shift lever moves the first and reverse sliding gear into mesh with the low gear on the countershaft (cluster) gear. Power flow is now from the input gear, through the countershaft gear to the first and reverse sliding gear and out through the output shaft.

When second gear is selected, the shift lever moves the second and third speed synchronizer sleeve rearward to force the blocking ring conical surface against the matching cone on the constant mesh intermediate gear located on the output shaft. When the vehicle is moving, as when shifting from low to a higher gear ratio, the internal teeth of the synchronizer sleeve and those on the blocking ring will not index until the intermediate gear is brought up or down to the speed of the synchronizer sleeve which is rotating at output shaft speed.

The synchronizer sleeve with further movement will slide over the blocking ring and engage the clutch teeth on the constant mesh intermediate gear. Since the intermediate gear is now locked to the output shaft by means of the synchronizer sleeve, power flow is from the input shaft through the countershaft gear to the constant mesh intermediate gear to the output shaft.

Engagement of third speed is the same as second except for ratio. In third gear, the clutch teeth on the input shaft are locked directly to the output shaft by the second and third speed synchronizer to provide a ratio of 1:1.

Reverse gear is accomplished by moving the first and reverse sliding gear rearward to engage the reverse idler gear. The drive is then from the input gear, through the countershaft gear, to and through the reverse idler gear to the first and reverse sliding gear which is splined to the output shaft. The gears in this position will rotate the output shaft in a reverse direction.

An interlock pin prevents selection of more than one gear at a time. Detent balls are provided to hold the selected gear in the desired position.

2 IN-CAR ADJUSTMENT AND REPAIRS

GEAR SHIFT LINKAGE ADJUSTMENT

If the transmission shifts hard, or if it will not engage, the gear shift linkage may need adjustment at the cross-over. Move the selector lever through all shift positions to see that cross-over operation is smooth. If cross-over operation is not smooth, adjust the cross-over linkage.

With the selector lever in neutral, loosen the lock nut on each sleeve. Then, slide the sleeves up or down on the rods as required to obtain a smooth cross-over. Each time a sleeve is moved, it must be tightened on the rod before checking the cross-over operation.

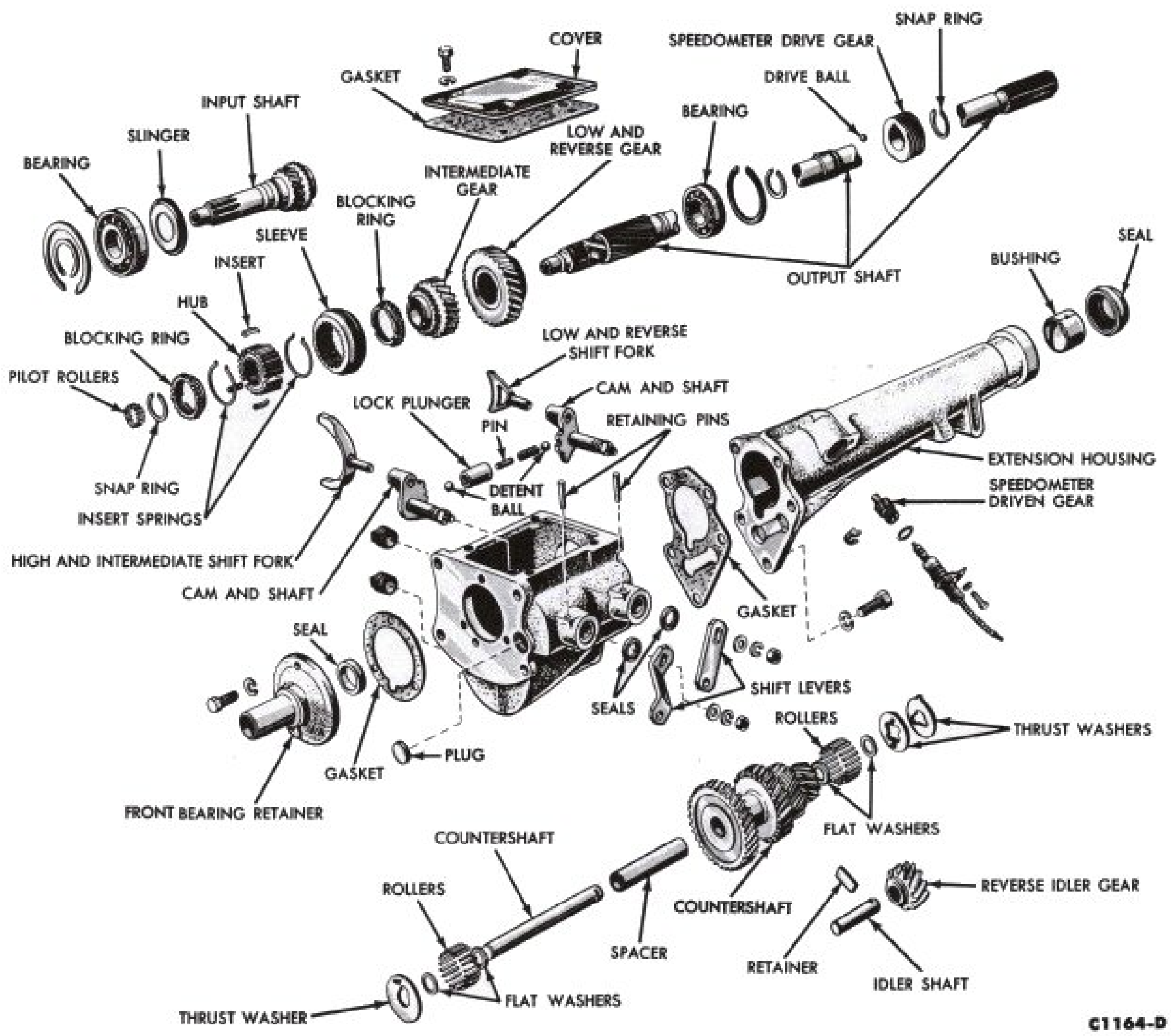


FIG. 2—Transmission Disassembled

3 REMOVAL AND INSTALLATION

REMOVAL

1. Raise the car on a hoist.
2. Remove the driveshaft. Insert the tool in Fig. 2, Part 6-1, into the opening of the extension housing to prevent the lubricant from leaking out.
3. Disconnect the speedometer cable from the extension housing, and disconnect the gear shift rods from the transmission shift levers.
4. Remove the two cap screws and lock washers that attach the transmission support spring to the extension housing.
5. Place a transmission jack under the flywheel housing and raise the rear of the engine slightly.
6. Remove the two bolts that attach the engine rear support to the underbody. Disconnect the brake cable from the engine rear support.
7. Move the jack under the transmission. Remove the four transmission mounting bolts.
8. Move the transmission back just far enough to clear the input shaft, and remove it from under the car.

INSTALLATION

1. Install two guide pins in the flywheel housing lower mounting holes. Start the input shaft through the release bearing and move the transmission forward on to the guide pins. If the transmission front bearing retainer hangs-up on the release bearing hub, move the clutch release lever to free it.
2. Move the transmission forward until the input shaft is through the clutch hub and enters the pilot bearing.
3. Install the two upper attaching bolts and lockwashers.
4. Remove the two guide pins and install the two lower attaching bolts. Torque all attaching bolts to specifications. Install the rear support before lowering the engine and removing the transmission jack.
5. Secure the extension housing to the rear support spring and install the brake cable.
6. Connect the gear shift rods and the speedometer cable.
7. Remove the tool (Fig. 2, Part 6-1) from the rear of the extension housing. Install the driveshaft, and torque the rear U-bolt nuts to specification.
8. Fill the transmission with approved lubricant. Check the shifting action of the transmission.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

1. Mount the transmission in a holding fixture and drain the lubricant.

2. Remove the transmission cover and gasket.

3. Remove the extension housing attaching bolts and remove the extension housing and gasket. To prevent the output shaft from following the housing (with the resultant loss of needle bearings), tap the end of the output shaft with a soft-faced hammer while withdrawing the extension housing.

4. Remove the speedometer drive gear snap ring, the gear, and drive ball from the output shaft.

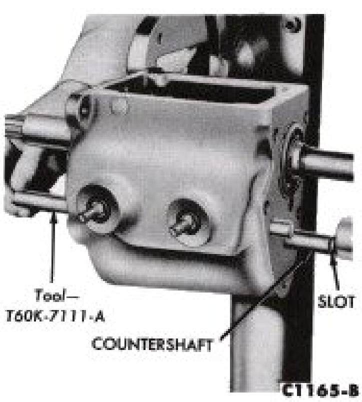


FIG. 3—Removing or Installing Countershaft

5. Remove the retainer for the reverse idler shaft and countershaft (Fig. 2).

6. Using the tool shown in Fig. 3, drive the countershaft rearward out of the countershaft gear and the transmission case. Then carefully lower the countershaft gear to the bottom of the case.

7. After removing the input shaft bearing retainer and gasket, remove the input shaft assembly and front synchronizer blocking ring from the transmission case (Fig. 4).

8. Remove the synchronizer retaining snap ring from the output shaft. Then, while holding the synchronizer assembly together, pull the output shaft out of the transmission case. The intermediate gear and the low and reverse gear will slide off the output shaft as it is withdrawn from the case. Lift the synchronizer assembly, intermediate, low and reverse sliding gears out of the case and remove the two shift forks. **For reference in assembly, notice which synchronizer hub end faces forward.**

9. Using a soft drift, drive the reverse idler shaft out of the transmission case. Lift the reverse idler gear and the countershaft gear out of the case.

10. Remove the shift levers.

PARTS REPAIR OR REPLACEMENT

CAM AND SHAFTS AND OIL SEALS

1. From the underside of the case, use a punch to drive out the tapered pins that hold the cam and shaft assemblies in the case (Fig. 5). **Use hard, firm blows.** Using a plastic hammer, drive the intermediate and

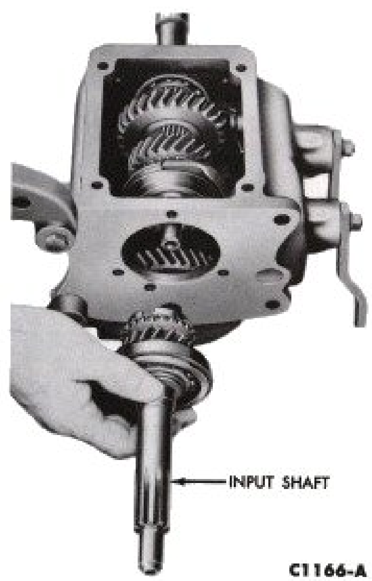


FIG. 4—Removing Input Shaft

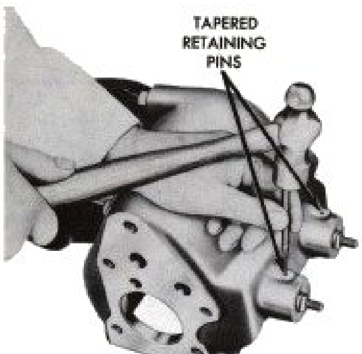


FIG. 5—Removing Cam and Shaft Retaining Pins

high cam and shaft toward the inside of the case and separate the detent balls and spring from the plunger. Push out the cam and shaft assemblies, and remove the plunger.

2. If required, the cam and shaft oil seals in the case may be removed with the tools shown in Fig. 6.

3. Use the tool shown in Fig. 7 to drive in the seals.

4. Install the reverse and low shift cam and shaft through the case opening. Assemble the spacer and spring in the plunger. Apply grease to each ball and position them in each end of the plunger. Hold the plunger assembly in position and install the intermediate and high cam and shaft in the case opening, allowing the balls to register in the cam detents.

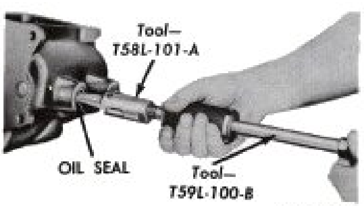


FIG. 6—Removing Cam and Shaft Oil Seals

5. Align the cam and shaft grooves with the openings in the shaft bosses in the case, and install the retaining pins. Check the cam action. Bent pins may restrict movement.

INPUT SHAFT BEARING

1. Remove the snap ring securing the input shaft bearing, and press the input shaft out of the bearing and oil slinger.

2. Press the input shaft bearing

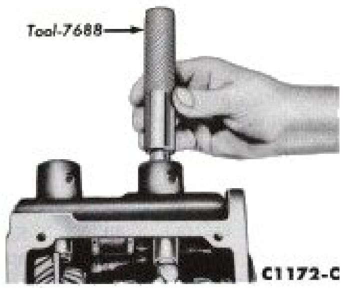


FIG. 7—Installing Cam and Shaft Oil Seals

and oil slinger onto the input shaft with the tool shown in Fig. 8, and install the snap ring on the shaft.

OUTPUT SHAFT BEARING

1. Remove the snap ring securing the output shaft bearing. Remove the bearing as shown in Fig. 9.

2. Press the output shaft bearing onto the shaft as shown in Fig. 9 and install the snap ring on the shaft.

SYNCHRONIZER

1. Remove the synchronizer sleeve, blocking rings, inserts, and retainers from the synchronizer hub.

2. Hold the three inserts in place in the synchronizer hub (Fig. 2).

3. Align the etch mark on the hub with the etch mark on the sleeve. Slip the hub and inserts into the sleeve making sure that the etch marks are aligned.

4. Secure the hub and inserts in the sleeve with the two insert springs.

COUNTERSHAFT GEAR BEARINGS

1. Remove the flat washers, dum-

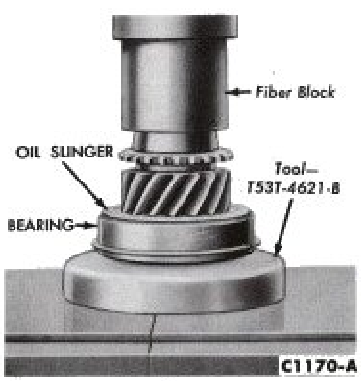


FIG. 8—Installing Input Shaft Bearing

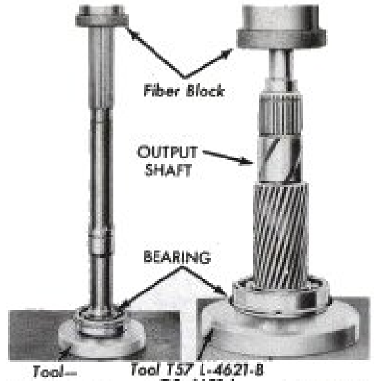


FIG. 9—Replacing Output Shaft Bearing

my shaft, spacer, and needle bearings from the countershaft gear.

2. Insert the spacer and dummy shaft into the countershaft gear. Position one flat washer at each end of the spacer (Fig. 2). Apply a coating of grease to the other two flat washers and the thrust washers and assemble at each end of the countershaft gear. **Note the position of the tangs on the thrust washers.**

3. Position the gear assembly in the bottom of the transmission case with the larger gear toward the front of the case.

FRONT BEARING RETAINER SEAL

1. Remove the input shaft seal from the front bearing retainer as shown in Fig. 10.

2. Install a new input shaft seal as shown in Fig. 11.

ASSEMBLY

1. If the countershaft, roller bearings and thrust washers are not already positioned in the bottom of the case, do it at this time.

2. Position the reverse idler gear, and insert the shaft (from the rear) through the case just far enough to hold the gear.

3. Using a light coat of grease, assemble the needle bearings in the input shaft. Install the front synchronizer blocking ring on the input shaft.

4. Install the shift forks on the cam and shaft assemblies, with the large fork on the intermediate and high cam and shaft. The web of the low and reverse fork must be to the rear of the shaft center.

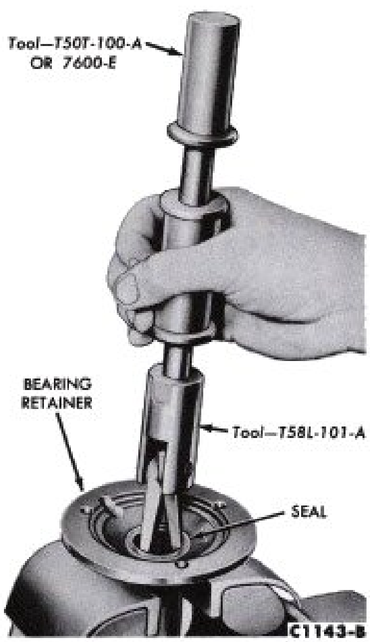


FIG. 10—Removing Input Shaft Seal

5. Start the output shaft through the rear opening of the transmission case. Place the low and reverse gear on the shaft, followed by the intermediate gear. Tilt the output shaft enough to allow the rear shift fork to engage the sliding gear groove.

6. **With the longer hub end forward,** slide the synchronizer assembly onto the output shaft and engage the synchronizer sleeve in the intermediate and high shift fork.

7. Install the synchronizer hub snap ring.

8. Position the input shaft and synchronizer front blocking ring.

9. Place a new gasket on the input shaft bearing retainer. Install the input shaft bearing retainer, using sealer on the bolts. Line up the drain groove in the retainer with the oil hole in the case.

10. Raise the countershaft gear to align the dummy shaft with the countershaft holes in the case. Start the countershaft into the case from the rear, and carefully drive the shaft into position.

11. Install the idler gear shaft and the retainer.

12. Install the speedometer drive gear and drive ball. Then secure the gear with the snap ring.

13. Install a new gasket, and the extension housing, using sealer on the bolts. Torque the bolts to specification.

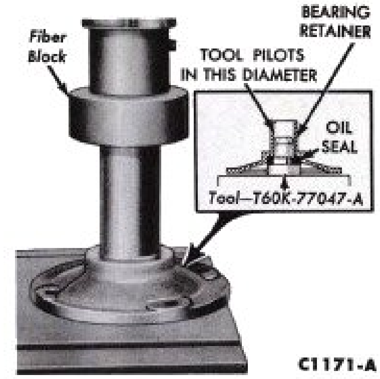


FIG. 11—Installing Input Shaft Seal

14. Install the shift levers.

15. If the extension housing bushing and/or seal is to be replaced, refer to Part 6-1, Section 2, for the detailed instructions.

16. Check transmission operation through all shift positions.

17. Fill the transmission to the proper level and install the transmission case cover and gasket. Use sealer on the bolts. **The gasket vent holes must be toward the rear, and the cover vent hole must be toward the front.**

PART 6-3 MODEL 3.03 THREE-SPEED TRANSMISSION

1 DESCRIPTION AND OPERATION

DESCRIPTION

The 3.03 HEF Model three-speed transmission (Fig. 1) is used on all models having a 260 or 289 C.I.D. engine. The designation 3.03 is the actual distance between the centerline of the countershaft and the centerline of the input shaft.

This transmission is of the fully synchronized type, with all gears except the reverse gear and sleeve being in constant mesh. All forward-speed changes are accomplished with synchronizer sleeves (Fig. 2) instead of sliding gears. The synchronizers enable quicker shifts, greatly reduce gear clash and permit down-shifting, high to intermediate between 40-20 mph and from intermediate to low below 20 mph.

The forward-speed gears are helical-cut and are in constant mesh (Fig. 2). Gears used in the reverse gear train are spur-cut and are not synchronized.

Ball bearings support the input shaft and gear and the center of the output shaft (Figs. 12 and 14). Roller bearings in the input shaft bore support the front of the output shaft. The countershaft gear (cluster gear) runs on two rows of roller bearings. Two bronze bushings are used in the reverse idler gear (Fig. 11). A bushing located at the rear of the extension housing supports the rear of the output shaft.

Synchronizers and blocking rings are the conventional tapered ring and straight clutch gear type (Figs. 16 and 17).

The shift forks, shift rails, detent mechanism, and related parts are provided in the transmission case (Fig. 8).

OPERATION

When the first-speed gear is selected, the shift lever moves the reverse gear and sleeve forward and forces the synchronizer blocking ring conical surface against the matching cone on the constant mesh

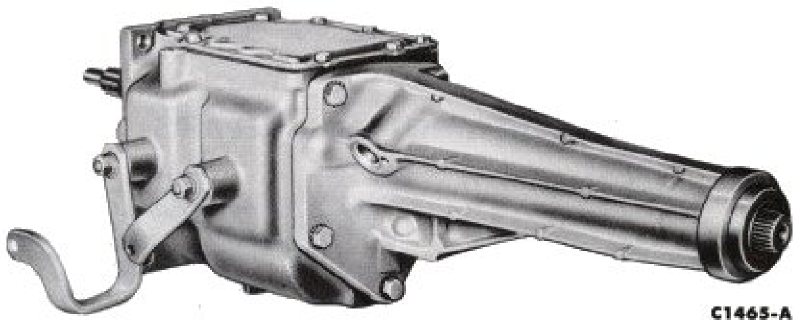


FIG. 1—3-Speed Transmission

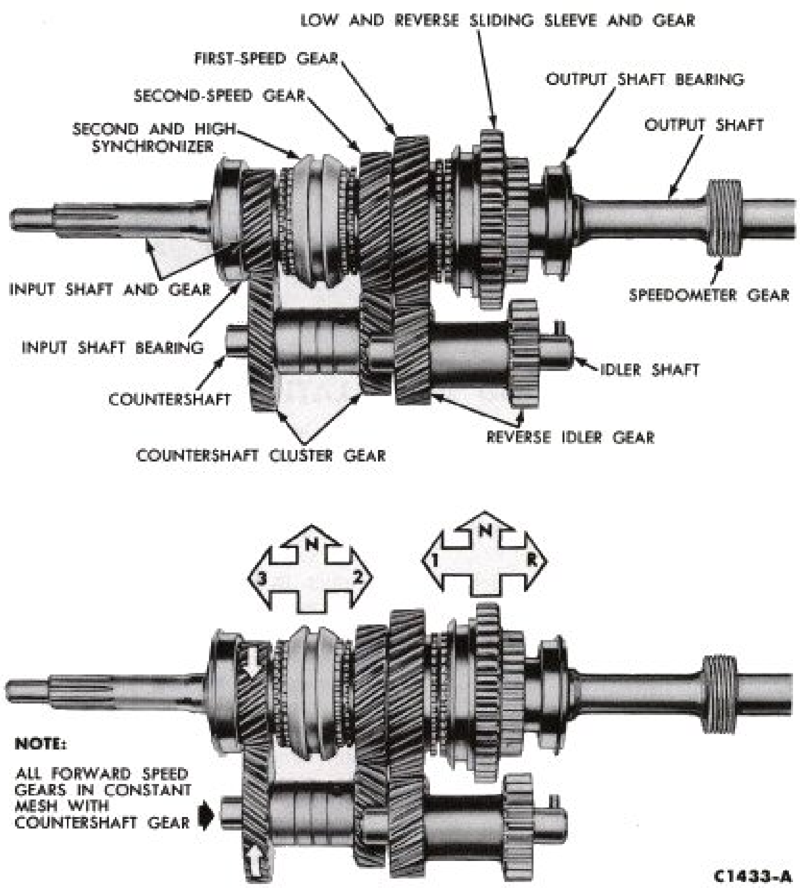


FIG. 2—Power Flow—3-Speed Transmission

first gear located on the output shaft. If the car is moving, the internal teeth of the reverse gear and sleeve and blocking ring will not index until the constant mesh first gear is brought up or down to the speed of the reverse gear and sleeve which is rotating at output shaft speed.

The reverse gear and sleeve has internal splines that, with further movement, will slide over the blocking ring and engage external clutch teeth on the constant mesh first gear. Since first gear is now locked to the output shaft and is always meshed with the countershaft (cluster) gear, the power flow is from the input gear, through the countershaft gear, to the constant mesh first gear, through the reverse gear and sleeve to the output shaft, and out the rear of the transmission.

Engagement of second and third gears is the same as first except for ratio. In third gear, the input gear and shaft is locked directly to the output shaft by the second and third speed synchronizer to provide a ratio of 1:1.

Spur teeth are cut on the outside of the reverse gear and sleeve. The reverse gear and sleeve like the hub are always locked to the output shaft. Reverse gear is engaged by sliding the reverse gear and sleeve into mesh with the spur gear at the rear of the idler gear. The drive is then from the input gear, through the countershaft gear, to and through the reverse idler gear to the output shaft reverse gear and sleeve. The gears in this position will rotate the output shaft in a reverse direction.

A system of interlocks and detents in the transmission case prevents the selection of more than one gear at a time and helps to hold any gear in the selected position.

2 IN-CAR ADJUSTMENT AND REPAIRS

SHIFT LINKAGE ADJUSTMENT

1. Place the gear shift lever in the neutral position.

2. Loosen the two gearshift rod adjustment nuts (Fig. 3).

3. Insert a 3/16-inch diameter alignment pin through the first and reverse gearshift lever and the second and third gearshift lever. It may be necessary to align the levers to insert the pin.

4. Tighten the two gearshift rod adjustment nuts.

5. Remove the alignment pin from the levers.

6. Start the engine and shift the selector lever to each position to make sure it operates freely.

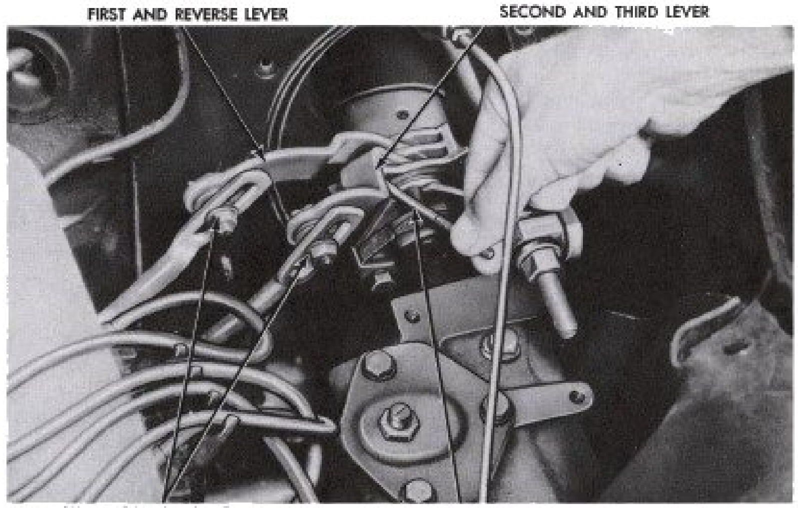


FIG. 3—Gearshift Linkage Adjustment—Typical

3 REMOVAL AND INSTALLATION

REMOVAL

1. Raise the car on a hoist and drain the lubricant from the transmission.

2. Disconnect the driveshaft from the rear U-joint flange.

3. Slide the front of the driveshaft out of the extension housing and off the output shaft. Insert the tool shown in Fig. 2, Part 6-1, to prevent the lubricant from leaking out.

4. Remove the cap screw and lock washer that secures the speedometer cable retainer to the extension housing. Pull the speedometer cable out of the extension housing.

5. Remove the cotter pin, flat washer, and spring washer that secure the shift rods to the shift levers on the transmission.

6. Disconnect the parking brake cable from the equalizer.

7. Remove the two cap screws and lock washers that secure the extension housing to the support spring.

8. Raise the rear of the engine enough to remove the weight from the frame crossmember. Remove the engine rear support attaching bolts, washers and remove the support and the spring as an assembly.

9. Support the transmission with a transmission jack and remove the four flywheel-housing-to-transmission case attaching bolts and lock washers.

10. Move the transmission and jack rearward until the input shaft is clear of the flywheel housing.

11. Remove the transmission from the jack and mount it in a holding fixture.

INSTALLATION

1. Make certain that the machined surfaces of the transmission case and the flywheel housing are free of dirt, paint and burrs.

2. Install a guide pin in each lower mounting bolt hole.

3. Start the input shaft through the release bearing. Align the splines on the input shaft with the splines in the clutch disc. Move the transmission forward on the guide pins until the input shaft pilot enters the bearing or bushing in the crankshaft. If the transmission front bearing retainer binds up on the clutch release bearing hub, work the release

bearing lever until the hub slides onto the retainer. Install the two transmission - to - flywheel housing upper mounting bolts and lock washers. Remove the two guide pins and install the lower mounting bolts and lock washers. Torque the four mounting bolts to specifications.

4. Raise the rear of the engine high enough to provide clearance for installing the engine rear support. Secure the support and spring with the attaching bolts and lock washers.

5. Lower the engine until the extension housing just contacts the support spring. Align the bolt holes in the extension housing with those in the spring, then lower the engine and remove the jack. Install the two extension housing-to-support attaching bolts and lock washers.

6. Insert the parking brake front cable in the equalizer and install the equalizer in the bracket on the cross-member. Secure the parking brake rear cable to the equalizer with a cotter pin.

7. Connect each shift rod to its respective lever on the transmission with a spring washer, flat washer and cotter pin.

8. Insert the speedometer cable and driven gear in the extension housing and secure with a cap screw and lock washer.

9. Remove the tool shown in Fig. 2, Part 6-1, from the extension housing. Slide the front universal joint yoke onto the output shaft and into the extension housing. Connect the rear universal joint to the axle pinion flange and torque the nuts to specifications.

10. Fill the transmission to the proper level with the approved lubricant.

11. Adjust the clutch pedal free travel and the shift linkage as required.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

1. Mount the transmission in a holding fixture.

2. Remove the nine cap screws that attach the cover to the case. Remove the cover and the gasket (Fig. 4) from the case. Remove the plug, detent spring and the detent plug from the top of the case (Fig. 8).

3. Remove the five cap screws and lock washers that attach the extension housing to the case. Remove the extension and gasket from the case.

4. Remove the four cap screws and lock washers that attach the front bearing retainer to the case. Remove the retainer and gasket from the case.

5. Remove the lubricant filler plug from the right side of the case. Working through the plug opening, drive the roll pin out of the case and countershaft with a ¼-inch punch (Fig. 5).

6. Hold the countershaft gear with a hook and with the tool shown in Fig. 6, push the countershaft out the rear of the case.

The countershaft (cluster) gear and thrust washers (Fig. 10) can be lowered to the bottom of the case. Remove the countershaft from the rear of the case.

7. Remove the snap ring that secures the speedometer drive gear on the shaft. Slide the speedometer drive gear off the output shaft. Remove the speedometer drive gear lock ball from the shaft.

8. Remove the snap ring that retains the output shaft bearing on the shaft. Remove the bearing from the case and shaft as shown in Fig. 7.

9. Place both shift levers in the neutral (center) position.

10. Remove the set screw (Fig. 8) that retains the detent springs and plugs in the case. Remove the detent spring and plug from the case.

11. Remove the set screw that secures the first and reverse shift fork to the shift rail. Slide the first and reverse shift rail out through the rear of the case.

12. Slide the first and reverse

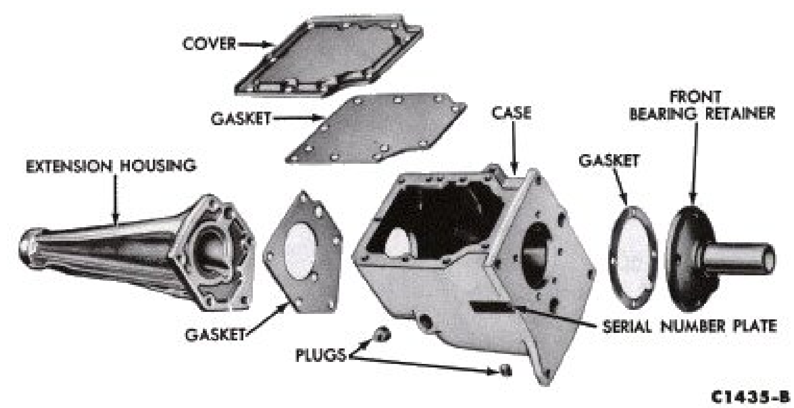


FIG. 4—Transmission Case and Related Parts

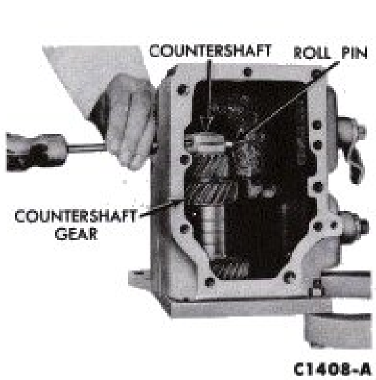


FIG. 5—Removing Countershaft Roll Pin

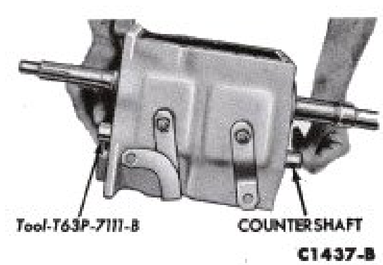


FIG. 6—Removing Countershaft

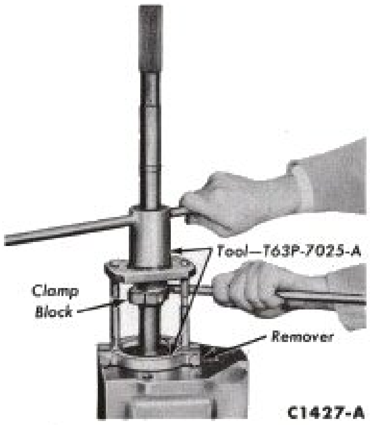


FIG. 7—Removing Output Shaft Bearing

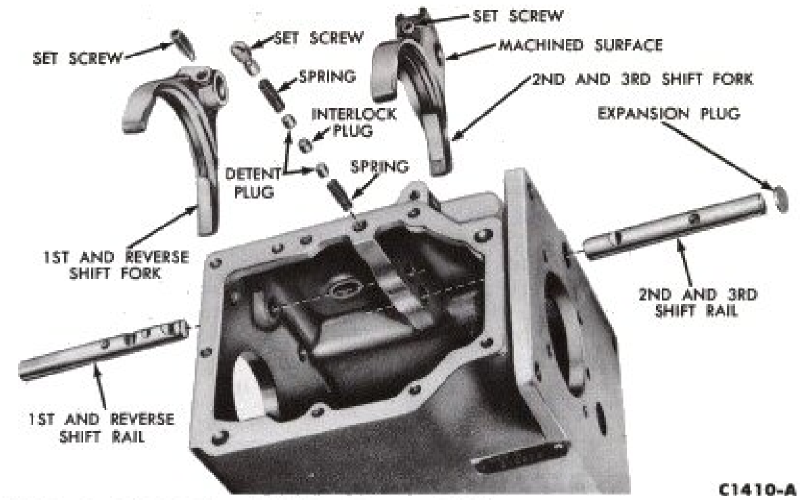


FIG. 8—Shift Rails and Forks—Disassembled

synchronizer forward as far as possible, then rotate the first and reverse shift fork upward, then lift it from the case.

13. Move the second and third-speed shift fork to the second speed position to gain access to the set screw. Remove the set screw from the fork. Rotate the shift rail 90° as shown in Fig. 9.

14. Lift the interlock plug (Fig. 8) from the case with a magnet.

15. Tap on the inner end of the second and third shift rail to remove the expansion plug (Fig. 8) from the front of the case. Remove the shift rail.

16. Remove the second and third detent plug and spring from the detent bore.

17. Pull the input shaft and gear out the front of the case.

18. Rotate the second and third shift fork upward, and lift it from the case.

19. Carefully lift the output shaft assembly out through the top of the case.

20. Lift the reverse idler gear and two thrust washers (Fig. 11) from the case.

21. Remove the snap ring from the front of the output shaft, then slide the synchronizer and the second speed gear (Fig. 12) off the shaft.

22. Remove the next snap ring and tabbed thrust washer from the output shaft, and then slide the first gear and blocking ring off the shaft.

23. Remove the next snap ring from the output shaft, and slide the reverse gear and sleeve off the shaft.

PARTS REPAIR OR REPLACEMENT

SHIFT LEVERS AND SEALS

1. Remove the nut, lock washer and flat washer that secures each shift lever (Fig. 13) to the lever and shaft in the transmission case. Lift the levers off the shafts. Slide each lever and shaft out of the case. Discard the "O" ring from each shaft.

2. Lubricate the new seals with transmission lubricant and install them on the shafts.

3. Install the lever and shafts in the case.

4. Position a shift lever on each shaft and secure them with a flat washer, lock washer and nut.

INPUT SHAFT BEARING

1. Remove the snap ring securing the input shaft bearing (Fig. 14), and press the input shaft out of the bearing and oil slinger.

2. Press the input shaft bearing and oil slinger onto the input shaft with the tool shown in Fig. 15 and install the snap ring on the shaft.

SYNCHRONIZERS

1. Push the synchronizer hub from each synchronizer sleeve.

2. Separate the inserts and insert springs from the hubs. Do not mix the parts from the second and third-speed synchronizer with the first and reverse synchronizer (Figs. 16 and 17).

3. If the tip of the first and reverse synchronizer rear insert spring is less than 0.120-inch in length (Fig. 16) replace it.

4. Install the rear insert spring

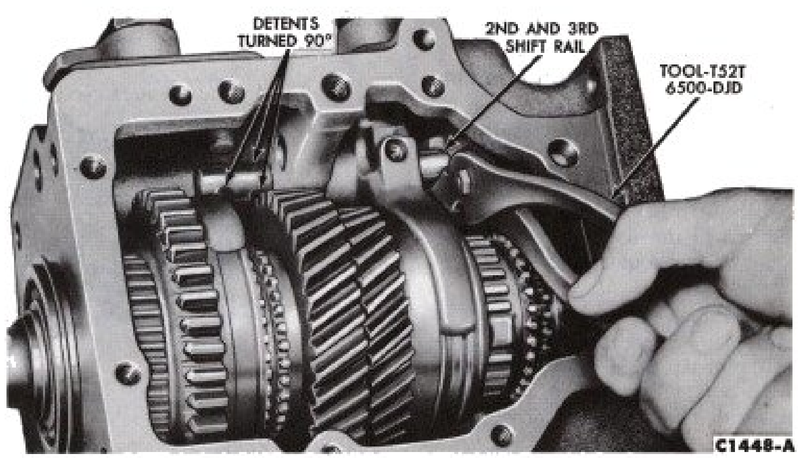


FIG. 9—Rotating Second and Third-Speed Shift Rail

(Fig. 18) in the groove of the first and reverse synchronizer hub. Make sure that the spring covers all insert grooves. Start the hub in the sleeve making sure that the alignment marks are properly indexed. Position the three inserts in the hub making sure that the small end is over the spring and that the shoulder is on the inside of the hub. Slide the sleeve and reverse gear onto the hub until the detent is engaged. Install the front insert spring in the hub to hold the inserts against the hub.

5. Install one insert spring (Fig. 17) into a groove of the second and third speed synchronizer hub, making sure that all three insert slots are fully covered. With the alignment marks on the hub and sleeve aligned, start the hub into the sleeve. Place the three inserts on top of the retaining spring and push the assembly together. Install the remaining insert spring, so that the spring ends cover the same slots as does the other spring. Do not stagger the springs. Place a synchronizer blocking ring on each end of the synchronizer sleeve.

COUNTERSHAFT GEAR BEARINGS

1. Remove the dummy shaft, 50 roller bearings, and the two bearing retainer washers from the countershaft gear (Fig. 10).

2. Coat the bore in each end of the countershaft gear with grease.

3. Hold the dummy shaft in the gear and install the 25 roller bearings and a retainer washer in each end of the gear.

ASSEMBLY

1. If the countershaft has not already been installed, position the countershaft, dummy shaft, roller bearings, and thrust washers in the transmission case. The countershaft will remain in the bottom of the case until the output and the input shafts have been installed.

2. Lubricate the output shaft splines and machined surfaces with transmission lubricant.

3. Slide the first and reverse gear and sleeve (Fig. 12) onto the output shaft with the teeth end of the gear facing toward the rear of the shaft. Secure it in place with the snap ring.

4. Coat the tapered machined surface on the first gear with grease. Place the blocking ring on the greased surface.

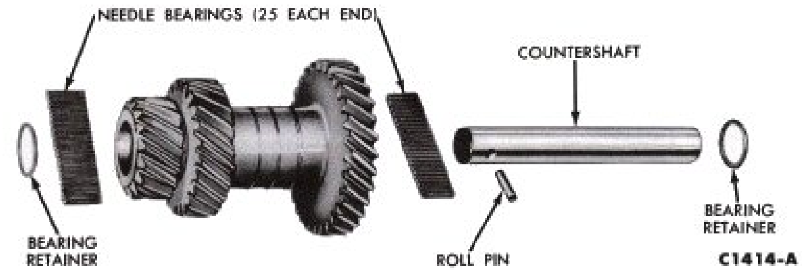


FIG. 10—Countershaft Gear Disassembled

5. Slide the first gear onto the output shaft with the blocking ring toward the rear of the shaft. Rotate the gear as necessary to engage the three notches in the blocking ring with the synchronizer inserts. Secure the first gear with the thrust washer and snap ring.

FIG. 11—Reverse Idler Shaft and Gear Disassembled

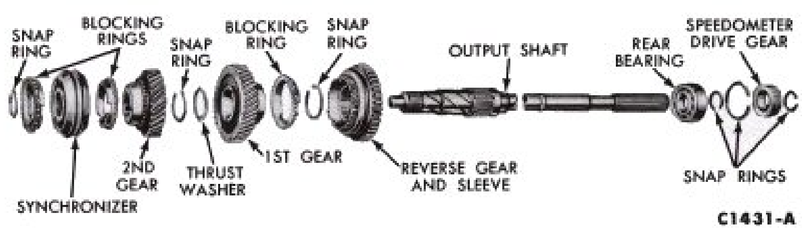


FIG. 12—Output Shaft—Disassembled

6. Coat the tapered machined surface of the second gear with grease and slide the blocking ring onto it. Slide the second gear with blocking ring and the second and third gear synchronizer onto the mainshaft. The tapered machined surface of the second gear must be toward the front of the shaft. Make sure that the notches in the blocking ring engage the synchronizer inserts. Secure the synchronizer with a snap ring.

7. Coat the bore of the input shaft and gear with a thin film of grease. **A thick film of grease will plug the lubricant holes and prevent lubrication to the bearings.** Install the 15 bearings (Fig. 14) in the bore.

8. Position the output shaft assembly in the case. Position the second and third shift fork on the second and third speed synchronizer.

9. Place a detent plug spring and a plug in the case (Fig. 8). Place the second and third speed synchronizer in the second speed position (toward rear of transmission). Align the fork and install the second and third speed shift rail. It will be necessary to depress the detent plug to enter the rail in the bore. Move the rail inward until the detent plug en-

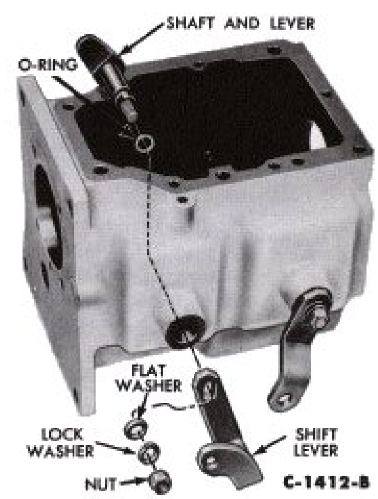


FIG. 13—Shift Lever and Shaft—Disassembled

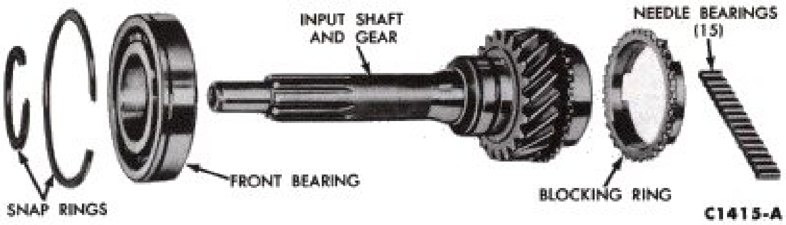


FIG. 14—Input Shaft Gear—Disassembled

gages the forward notch (second speed position).

10. Secure the fork to the shaft with the set screw. Move the synchronizer to the neutral position.

11. Install the interlock plug in the case. If the second and third shift rail is in the neutral position, the top of the interlock will be slightly lower than the surface of the first and reverse shift rail bore.

12. Move the first and reverse synchronizer forward to the first speed position. Place the first and reverse shift fork in the groove of the first and reverse synchronizer. Rotate the fork into position and install the first and reverse shift rail. Move the rail inward until the center notch (neutral) is aligned with the detent bore. Secure the fork to the shaft with the set screw.

13. Install a new expansion plug in the case.

14. Hold the input shaft and blocking ring in position, and then move the output shaft forward to seat the pilot in the roller bearings of the input gear.

15. Tap the input gear bearing into place in the case while holding the output shaft to prevent the roller bearings from dropping. Install the front bearing retainer and new gasket, making sure that the oil return slot is at the bottom of the case. Install and torque the four attaching screws to 19-25 ft-lbs.

16. Install the large snap ring on the rear bearing. Place the bearing on the output shaft with the snap ring end toward the rear of the shaft. Press the bearing into place with the tool shown in Fig. 19. Secure the bearing to the shaft with a snap ring.

17. Hold the speedometer drive gear lock ball in the detent and slide the speedometer drive gear into place. Secure the gear with a snap ring.

18. Place the transmission in the vertical position. Working through the drain hole in the bottom of the case, align the bore of the countershaft gear and the thrust washers with the bore of the case with a screwdriver.

19. Working from the rear of the case, push the dummy shaft out of the countershaft gear with the countershaft. Before the countershaft is completely inserted in the bore, make sure that the hole that accommodates the roll pin is in alignment with the hole in the case. Push the countershaft into place and install the roll pin.

20. Coat a new extension housing gasket with sealer and position it on the case.

21. Install lock washers on the five attaching screws. Dip the threads of the cap screws in sealer. Secure the housing to the case and torque the cap screws to 42-50 ft-lbs.

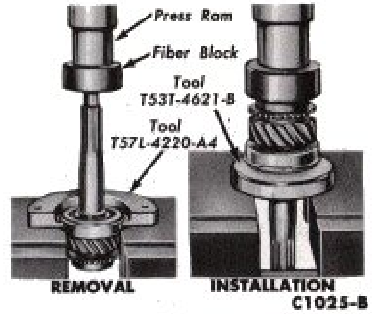


FIG. 15—Replacing Input Shaft Bearing

22. Install the filler and drain plugs in the case. Make sure that the magnetic plug is installed in the bottom of the case.

23. Place the transmission in gear. Pour lubricant over the entire gear train while rotating the input or output shaft.

24. Place a detent plug, spring and the remaining plug in the case (Fig. 8). Coat a new cover gasket (Fig. 4) with sealer. Secure the cover with nine cap screws. Torque the screws to 14-19 ft-lbs.

25. Check the operation of the transmission in all of the gear positions.

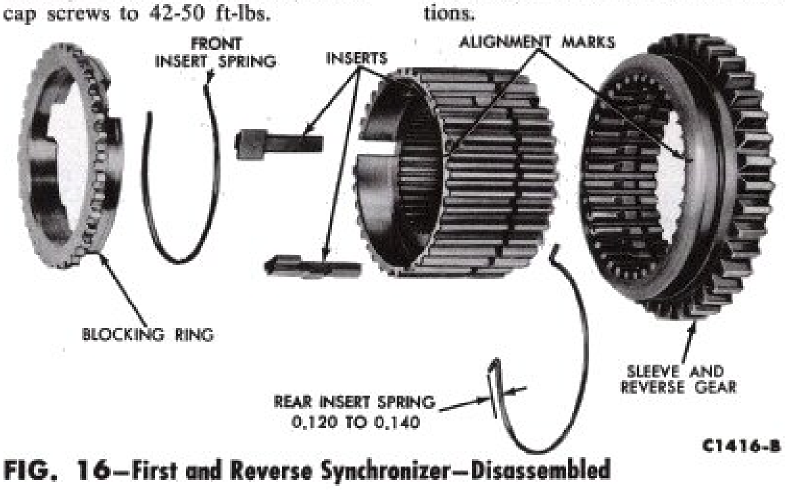


FIG. 16—First and Reverse Synchronizer—Disassembled

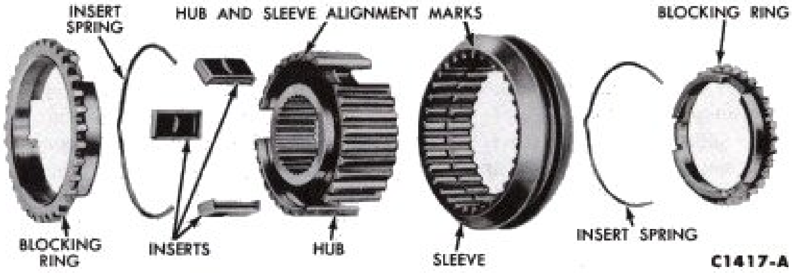


FIG. 17—Second and Third Synchronizer—Disassembled

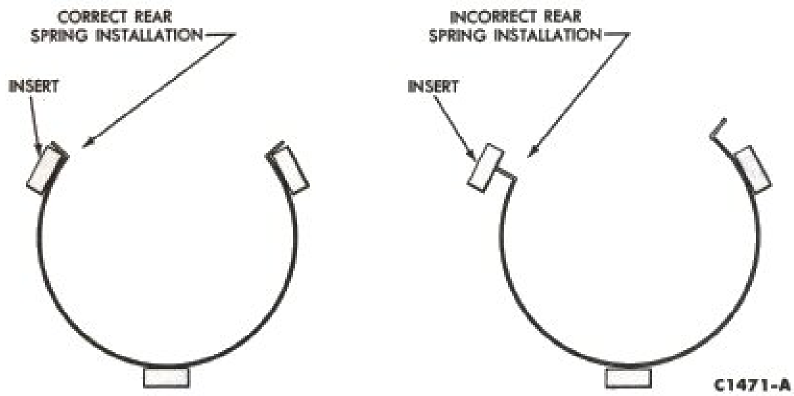


FIG. 18—First and Reverse Speed Synchronizer Insert Spring Installation

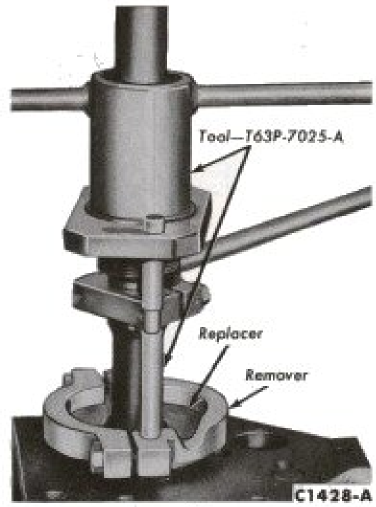


FIG. 19—Installing Output Shaft Rear Bearing

PART 6-4 DAGENHAM FOUR-SPEED TRANSMISSION

1 DESCRIPTION AND OPERATION

DESCRIPTION

1. The Dagenham four - speed transmission (Fig. 1) is of the fully synchronized type, with all gears except the reverse sliding gear being in constant mesh. All forward speed changes are accomplished with synchronizer sleeves (Fig. 2) instead of sliding gears. The synchronizers will enable quicker shifts, greatly reduce gear clash and permit downshifting in all forward speeds.

The shift linkage is mounted directly on the transmission extension housing (Fig. 1) and enters the driver's compartment through an opening in the floor pan. A flexible rubber boot is provided to seal the driver's compartment (Fig. 3) from the exterior.

The shift pattern is shown on the top of the gear shift lever knob. A finger-operated release lever is provided on the shift lever (Fig. 3) to prevent the transmission from being accidentally shifted into reverse gear.

The forward speed gears are helical-cut and are in constant mesh (Fig. 2). Gears used in the reverse gear train are spur-cut and are not synchronized.

Ball bearing assemblies support the input gear and the center of the output shaft (Figs. 9 and 10). Roller bearings in the input gear bore support the front of the output shaft. The countershaft gear (cluster) also runs on two rows of roller bearings. A bronze bushing is used in the reverse idler gear (Fig. 19). The rear of the output shaft is supported by the driveshaft front yoke which in turn runs on a steel-backed bushing that is pressed into the extension housing.

Synchronizers and blocking rings are the conventional tapered ring and straight clutch gear-type (Fig. 17).

A removable shift cover contains the shift cams, forks, shafts, detents and interlocks (Figs. 14 and 15).

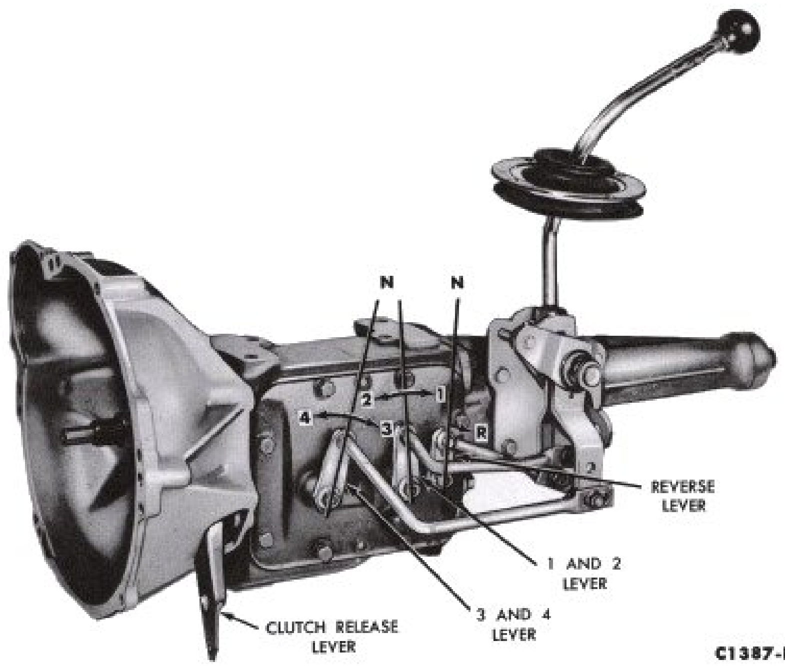


FIG. 1—4-Speed Floor Shift Transmission

OPERATION

When first gear is selected, the shift lever and linkage move the first and second shift fork and synchronizer sleeve toward the rear and force the synchronizer blocking ring conical surface against the matching cone on the output shaft first gear. If the car is moving, the synchronizer sleeve, blocking ring and first gear clutch

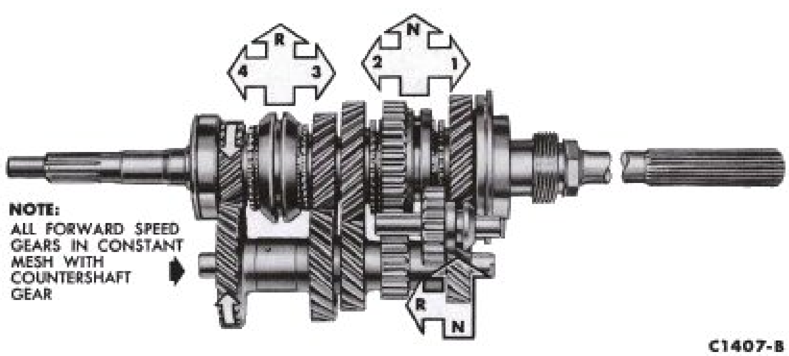


FIG. 2—Power Flow—4-Speed Transmission

FIG. 3—4-Speed Floor Shift Installed

teeth will not index until first gear is brought up or down to the speed of the synchronizer and the output shaft. The synchronizer sleeve has internal splines that, with further movement, will slide over the blocking ring and engage external clutch teeth on the first gear. Since first gear is now locked to the output shaft and is always meshed with the countershaft (cluster) gear, the power flow is from the input gear, through the countershaft gear, to the first gear on the output shaft, through the synchronizer sleeve and hub to the output shaft and out the rear of the transmission.

Engagement of second and third gears is the same as first except for ratio.

Fourth gear operation is accomplished in the same manner as first, second, and third, but the input gear is locked directly to the output shaft and the ratio is 1:1.

Spur teeth are cut on the outside of the first and second gear synchronizer sleeve. The sleeve and hub are always locked to the output shaft. Reverse gear is engaged by sliding an idler gear into mesh with the teeth on the first and second synchronizer sleeve and the spur teeth on the countershaft gear. The drive is then from the input gear, through the countershaft gear, through the idler gear, to the output shaft reverse gear (synchronizer sleeve) and the output shaft, which is rotated in a reverse direction.

A system of interlocks and detents in the shift cover prevents the selection of more than one gear speed at a time and helps to hold any gear in the selected position.

2 IN-CAR ADJUSTMENT AND REPAIRS

GEAR SHIFT LINKAGE ADJUSTMENT

To adjust the linkage, place the shift lever in the neutral position and raise the car on a hoist. Insert a ¼-inch drill or rod into the alignment hole as shown in Fig. 4. If the rod will not enter, check for bellied or bent shift rods. If the shift rods are the correct shape, check for loose lever lock nuts at the rod ends. Reset the linkage by loosening the three rod-retaining lock nuts and moving the levers until the ¼-inch gauge rod or drill will enter the alignment holes. Make sure the transmission shift levers are in neutral and the reverse shift lever is in the neutral detent (Fig. 1). If there is any doubt about location of the neutral position, disconnect the shift rods at the retaining lock nuts and rotate each forward speed shift lever through its three positions until the center (neutral) detent is positively located. Move the reverse shift lever forward until positive engagement of the detent is felt. Install the shift rods and torque the lock nuts to 15-20 ft-lbs. Remove the ¼-inch drill or rod. Operate the shift levers to make sure that the detents are engaging. Lower the car and check for smooth cross-over operation.

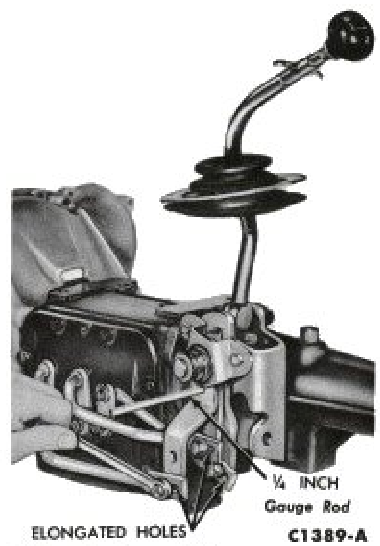


FIG. 4—Gear Shift Linkage Adjustment

3 REMOVAL AND INSTALLATION

REMOVAL

1. Working from inside the car, remove the four screws that attach the retaining ring and boot to the floor pan (Fig. 3).
2. Raise the boot and ring to gain access to the two cap screws that attach the shift lever to the shift linkage assembly (Fig. 3). Remove the cap screws and shift lever.
3. Raise the car, remove the starter cable from the starter, and remove the starter. Drain the transmission lubricant.
4. Disconnect the driveshaft at the pinion flange and tape the U-joint bearing races in place if the joint does not have a strap spot welded to it. Pull the driveshaft off the transmission and insert the tool shown in Fig. 2, Part 6-1 into the seal and extension housing to prevent lubricant leakage.
5. Remove the back-up lamp switch (if so equipped) from the shift linkage control bracket.
6. Remove the clip from the equalizer bar at the clutch release rod and remove the rod. Remove the linkage return spring from the release lever.
7. Disconnect the parking brake front cable from the equalizer bar. Disconnect the speedometer cable from the extension housing.
8. Support the engine with a jack and remove the two bolts that attach the rear mount spring to the extension housing.
9. Raise the rear of the engine and remove the transmission support cross-member from the underbody.

10. Support the transmission and remove the bolts that attach the flywheel housing to the engine and the cover to the housing. Remove the cover.

11. Move the transmission and clutch housing assembly toward the rear until the transmission input gear splines are clear of the clutch assembly. Lower the transmission.

INSTALLATION

1. Raise the transmission and align the input gear splines with those in the clutch hub. Move the transmission forward until the flywheel housing is against the engine.

2. Install the housing to engine bolts and torque them to specifications. Install the cover on the flywheel housing.

3. Position the engine rear support on the frame and install the attaching bolts.

4. Lower the engine and transmission onto the spring mount and install the spring to extension housing bolts. Torque the bolts to specifications.

5. Connect the parking brake front cable to the equalizer bar and the speedometer cable drive gear adapter to the extension housing.

6. Connect the clutch release rod to the clutch equalizer shaft and to the clutch release lever. Attach the retaining clip and lever return spring.

7. Remove the tool from the extension housing and slide the driveshaft yoke onto the transmission output shaft, being careful not to damage the seal.

8. Be sure the pinion flange locating slots are clean, and then position the U-joint. Install the bolts and torque them to specifications.

9. Install the back-up lamp switch (if the car is so equipped) on the shift linkage bracket.

10. Install the starter and cable.

11. Fill the transmission to the bottom of the fill plug hole with the specified lubricant.

12. Adjust the shift linkage as outlined in Section 2.

13. Lower the car and position the shift lever on the linkage assembly. Install the lever to linkage cap screws and torque them to specifications.

14. Install the boot and the retaining ring. Secure with the four screws (Fig. 3).

15. Drive the car to check for proper operation.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

1. Disconnect the three shift rods from the shift levers (Fig. 1). The reverse shift lever nut must be loosened to free the reverse rod.

2. Remove the three bolts that attach the shift selector assembly to the extension housing.

3. Insert a reworked screwdriver (Fig. 5) through the clutch release lever and unhook the retainer that secures the clutch release lever to the retainer bracket.

4. Remove the four bolts that attach the flywheel housing to the transmission.

5. Remove the eight attaching bolts and the shift cover from the transmission.

6. Remove the three bolts and the input gear bearing retainer from the front of the transmission.

7. Remove the four bolts that secure the extension housing and output shaft bearing adapter to the transmission case. In the event that two long and two shorter bolts are used, the two longer bolts must be installed in the upper right and lower left holes (viewed from the rear). Remove the extension housing.

8. Working from the front of the case, drive the countershaft, with a drift, until it is just clear of the front wall of the case. Using the tool shown in Fig. 6, push the countershaft out until the tool and countershaft (cluster) gear drop out of position.

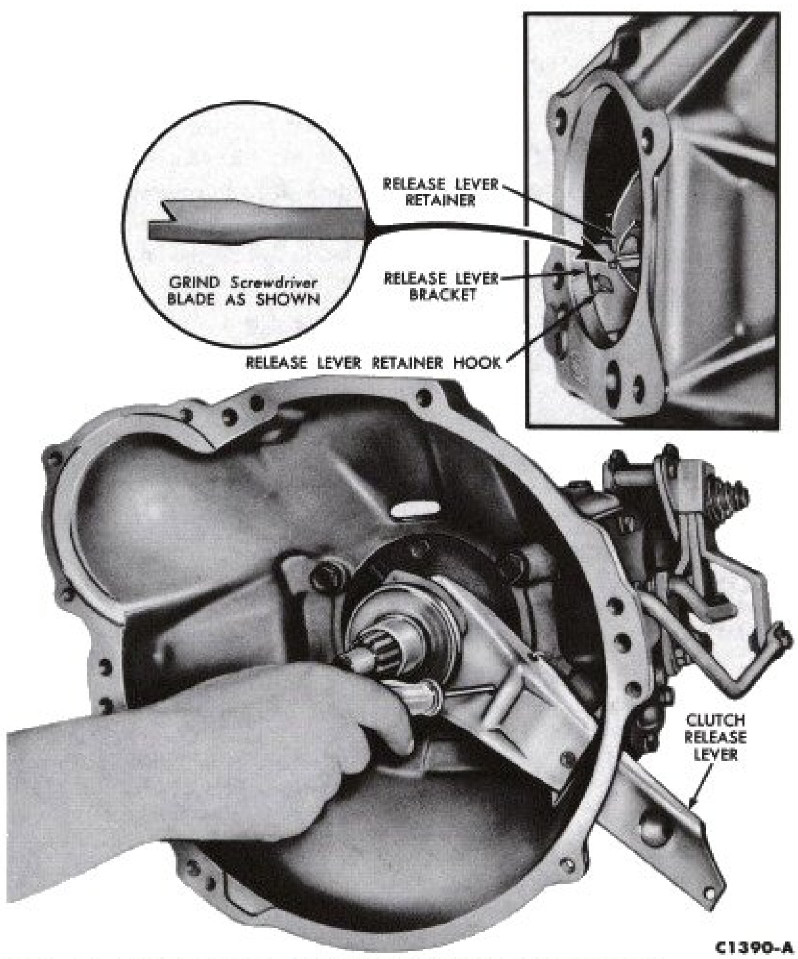


FIG. 5—Removing or Installing Clutch Release Lever Retainer

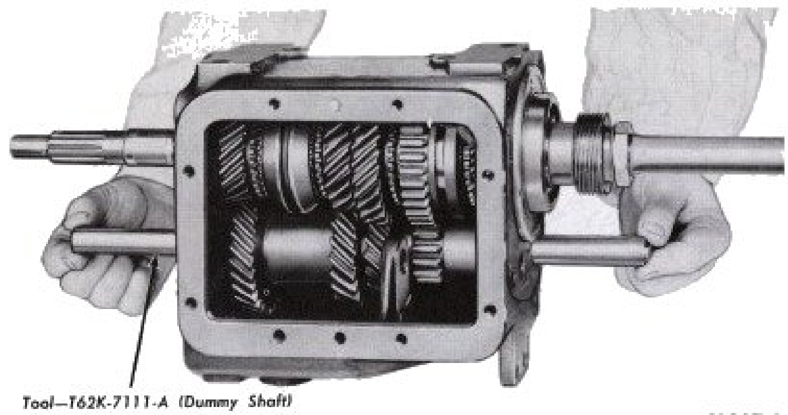


FIG. 6—Removing or Installing Countershaft

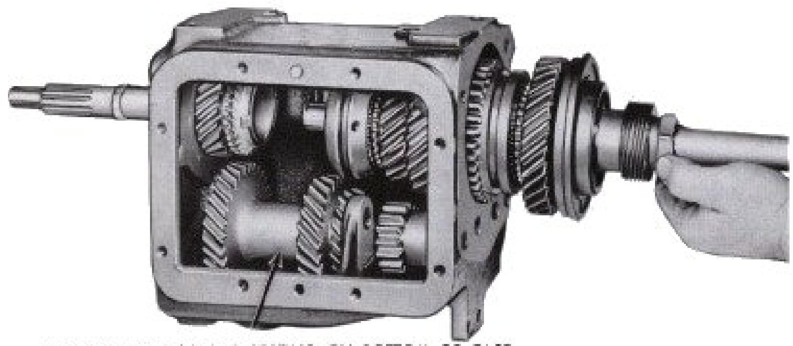


FIG. 7—Removing or Installing Output Shaft

9. Remove the output shaft assembly from the rear of the case (Fig. 7).

10. Remove the input gear and bearing (Fig. 8) from the front of the case.

11. Lift the countershaft gear assembly out through the cover opening of the case. Note that the smallest diameter thrust washer is positioned between the rear of the countershaft gear and the case and that the larger diameter steel and bronze washers are at the front (Fig. 18).

12. Thread a 5/16-24 bolt into the rear of the reverse idler gear shaft and pull the shaft using tools T50T-7140-B (adapter) and T59L-1000-A (puller). Remove the idler gear.

13. Remove the speedometer gear and drive ball. Remove the speedometer gear spacer (Fig. 9).

14. Place the output shaft assembly in an arbor press as shown in Fig. 10 and press the bearing, adapter, first gear, first and second synchronizer assembly, and second gear off the shaft

15. With snap ring pliers, remove the snap ring from in front of the 3-4 synchronizer on the output shaft. Press the third gear and the 3-4 synchronizer off the shaft as shown in Fig. 11.

PARTS REPAIR OR REPLACEMENT

GEAR SHIFT LEVER

1. Remove the snap ring from the end of the selector shaft with pointed snap ring pliers (Fig. 12).

2. Remove the flat washer and spring.

3. After removing two bolts, pull the retainer, selector levers, and bracket from the shaft.

4. Drive the short selector lever pin from the shaft with a large pin punch.

5. Drive the long trunnion pin from the shaft and remove the trunnion and shaft.

6. If necessary to remove the studs from the selector levers, remove the cotter pins, flat washers, wave washers and studs.

7. Lubricate all mating friction surfaces with Lubriplate before assembly.

8. Install the shaft in the bracket. Position the trunnion and drive the long straight pin through the trunnion and into the shaft until an equal length of the pin is exposed on both sides of the shaft.

9. Drive the short pin into the shaft until the pin is centered in the shaft.

10. Install the levers and the neu-

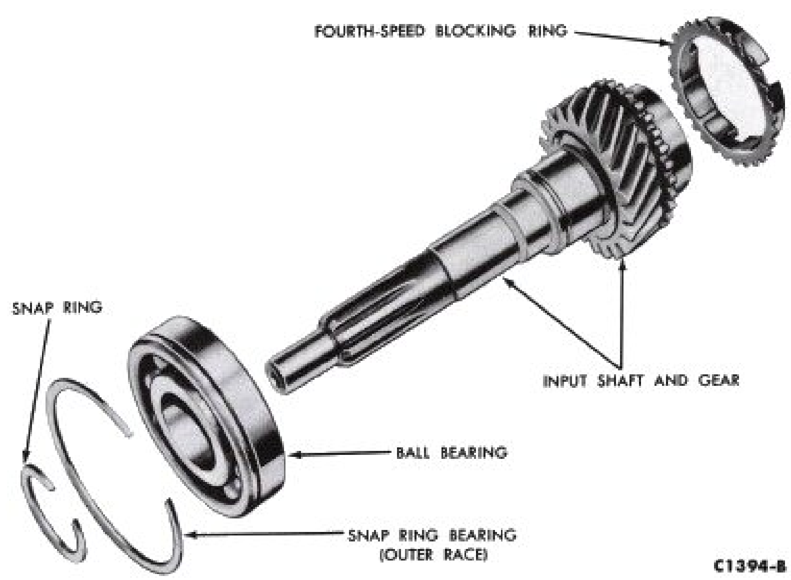


FIG. 8—Input Gear and Bearing Disassembled

tral index bracket on the shaft as shown in Fig 12.

11. Position the retainer and start the bolts. Before tightening the bolts be sure that the retainer is not interfering with free movement of the shaft. Tighten the bolts.

12. Install the spring, flat washer and snap ring.

13. Install the lever studs if they were removed.

SHIFT COVER

1. Remove the levers from the cam and shafts (Fig. 13).

2. Remove the roll pin from the upper fork shaft and remove the shaft and forks.

3. Remove the reverse cam and shaft.

4. Rotate the reverse fork and shaft assembly to disengage the detent ball and remove the fork and shaft (Fig. 14). Hold a cloth over the shaft cover boss nearest to the fork to catch the detent ball and spring when the shaft clears the boss hole.

5. Remove the 1-2 and 3-4 shift cam assemblies. Hold a cloth over the interlock and cam assemblies to catch the detent balls.

6. Push the interlock sleeve, spring and remaining ball out of the cover.

7. Remove the 1-2 and 3-4-to-reverse interlock pins from the reverse fork and shaft bosses in the cover.

8. If the seals need replacing, remove them with a screwdriver and install them as shown in Fig. 15.

9. Place the 1-2 and 3-4-to-reverse interlock pins in the holes in the reverse fork and shaft bosses (Figs. 13 and 14).

10. Install the 3-4 shift cam in the cover.

11. Install the parts of the 1-2 and 3-4 cam interlock, sleeve, ball, spring and another ball, in that order.

12. Hold the 3-4 cam in neutral position and the 1-2 ball depressed while the 1-2 cam is installed in the cover.

13. Install the 1-2 and the 3-4 levers, washers and nuts.

14. Check the clearance between the interlock, detent sleeve and the 1-2 and 3-4 shift cams in, and between, all shift positions. The sleeve to cam clearance must be a minimum of 0.0005 inch and a maximum of 0.010 inch. Service sleeves are available in the following lengths ±0.010 inch: 1.2875, 1.2905, 1.2935, 1.2965, 1.2995, and 1.3025.

15. With the 1-2 and 3-4 shift cams

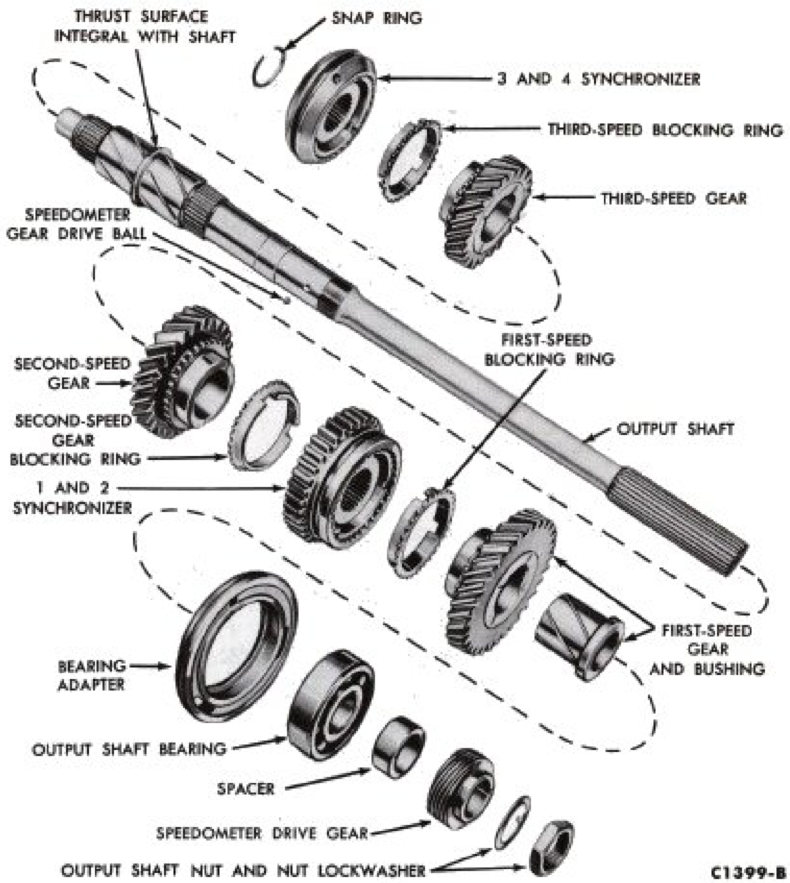


FIG. 9—Output Shaft Disassembled

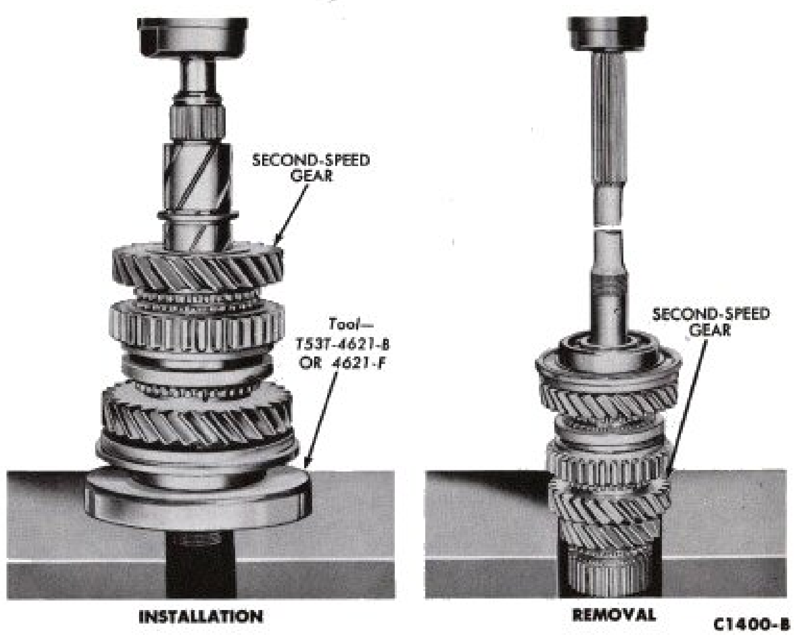


FIG. 10—Removing and Installing Output Shaft Bearing

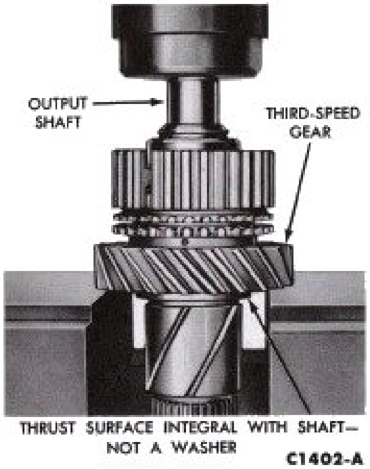


FIG. 11—Removing Third Gear and Third and Fourth Synchronizer Hub

in neutral and the 1-2 and 3-4-to-reverse interlock pin resting on the cams, install the reverse shaft detent spring and ball and the reverse fork and shaft.

16. Install the reverse shift cam through the cover and into the aligned fork and shaft. Install the reverse cam operating lever (washer and nut loose).

17. Position the 1-2 and 3-4 forks onto the shift cams and install the fork shaft. Align the shaft hole with the one in the cover and install the lock pin.

18. Check all shift positions for freedom of movement, detent and interlock action.

SYNCHRONIZERS

1. Before disassembling the synchronizers, scribe an alignment mark across the hub and sleeve if they do not have alignment marks. The alignment marks will permit the sleeves and hubs to be assembled in their original positions.

2. Remove the front and rear insert springs from both synchronizer assemblies (Fig. 16).

3. Slide the sleeves off the hubs. Remove the hub inserts (detents).

4. Place the long inserts (detents) into the slots in the 1-2 synchronizer hub and slide the combination sleeve and reverse gear over it making sure that the etch or scribe marks on the hub and sleeve are aligned (Fig. 16). Snap the insert springs into place. The tab on each spring must set into the underside of an insert.

5. Position the short inserts (detents) into the slots in the 3-4 synchronizer hub and slide the clutch sleeve over it making sure that the etch or scribe marks are aligned. Install the insert springs in the same manner as with the 1-2 synchronizer.

INPUT SHAFT BEARING

1. If the input gear bearing needs replacing, remove it as shown in Fig. 17.

2. Press the bearing onto the input gear with the outer race snap ring groove toward the front (Fig. 17).

3. Install the snap rings on the bearing outer race and on the gear shaft with snap ring pliers.

COUNTERSHAFT GEAR BEARINGS

1. Remove the thrust washers from each end of the countershaft gear (Fig. 18).

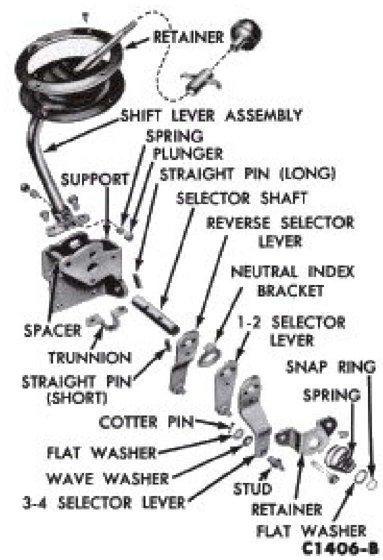


FIG. 12—Gear Shift Lever Disassembled

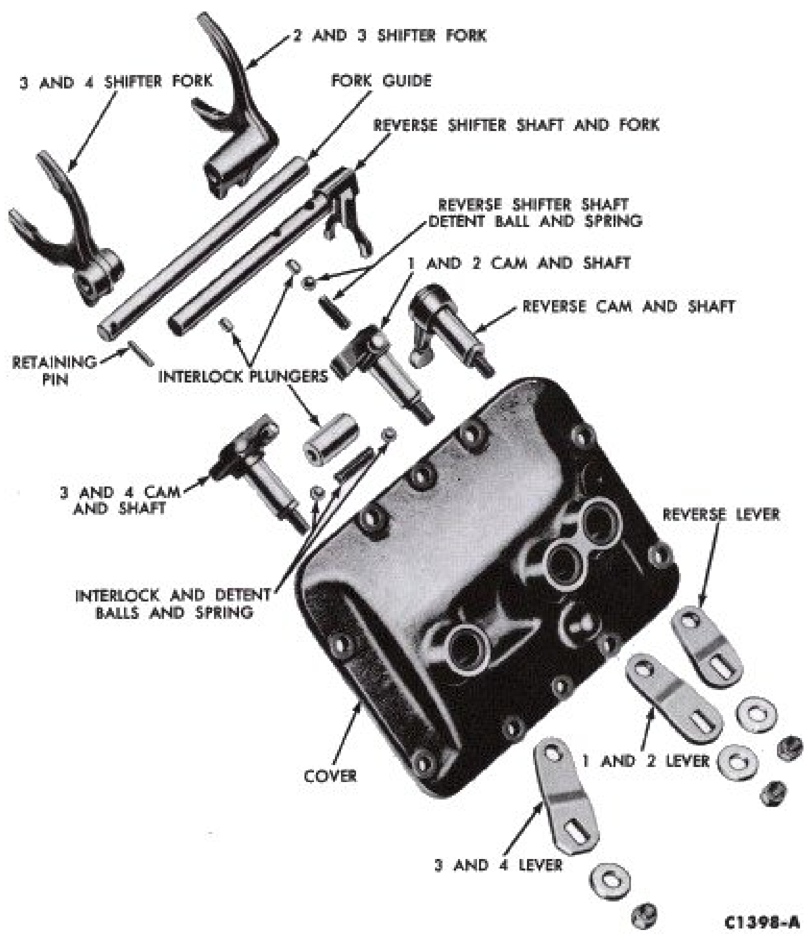


FIG. 13—Gear Shift Cover Disassembled

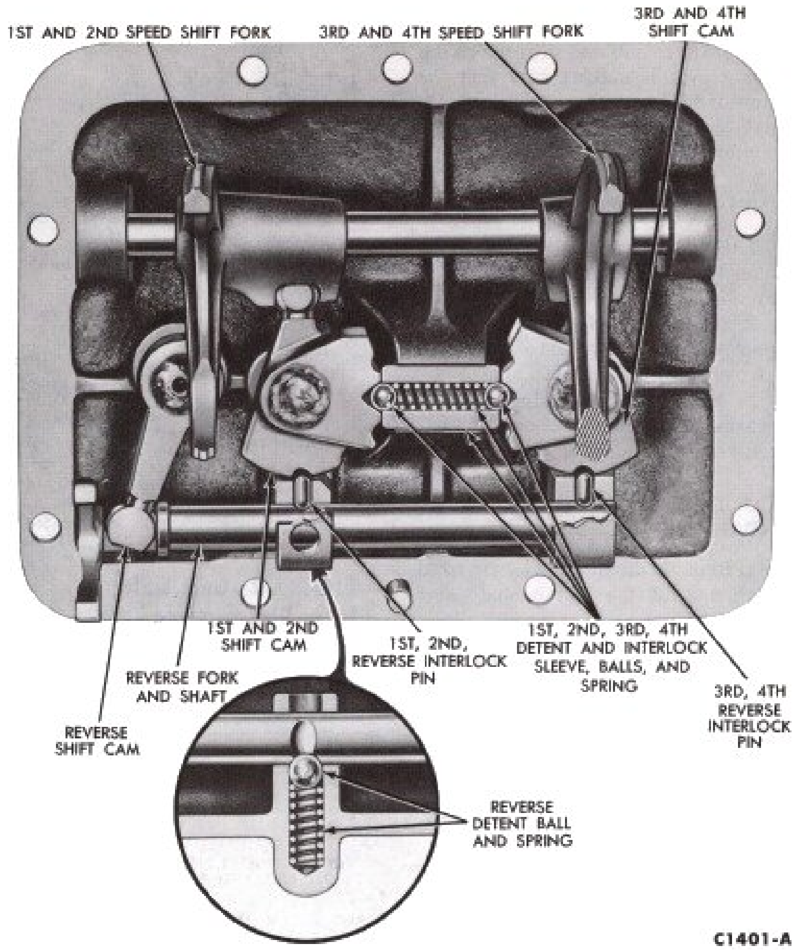


FIG. 14—Transmission Shift Mechanism Details

2. Remove the dummy shaft from the gear.

3. Remove the two washers and 22 roller bearings from each end of the gear.

4. Place the tool shown in Fig. 6 in the countershaft (cluster) gear. Starting on either end, drop a steel washer (Fig. 18) over the tool and into the gear. Coat each needle bearing with grease and install 22 of them into the gear. Lay another steel washer on the ends of the needles and the thrust washers that were previously selected.

5. Repeat the above operation for the other end of the gear. Do not lose the bearings and washers in the initially assembled end when inverting the gear to assemble the opposite end.

ASSEMBLY

1. Place the second gear on the rear of the output shaft with the clutch teeth and tapered synchronizer end toward the rear. Install a blocking ring with the clutch teeth toward the front (Fig. 9).

2. Install the first and second synchronizer and reverse gear assembly on the rear of the output shaft with the shift fork groove toward the rear. Be sure the second speed blocking ring is not cocked on the gear and that the three index slots align with the synchronizer inserts (detents).

3. Install the first speed blocking ring with the clutch teeth to the rear and the slots engaging the synchronizer inserts (detents).

4. Slide the first gear and sleeve onto the output shaft, taper and clutch teeth to front, and the sleeve (bushing) shoulder to the rear.

5. Assemble the output shaft ball bearing into the recess in the bearing adapter. Position the adapter and bearing on the rear of the output shaft with the adapter forward. Hold the first gear and sleeve (bushing) forward and place the assembly in a press with the tool resting against the rear of the bearing inner race. Press the bearing until it is seated firmly against the first gear sleeve (bushing).

6. Place the spacer, speedometer gear drive ball, speedometer gear (shoulder to rear), lock washer (tab into speedometer gear), and nut on the output shaft (Fig. 9). Torque the nut to specifications. Bend the washer over a flat on the nut.

7. Set the third speed gear on the front of the output shaft with the clutch teeth toward the front. Place the blocking ring on the gear.

8. Install the 3-4 synchronizer with

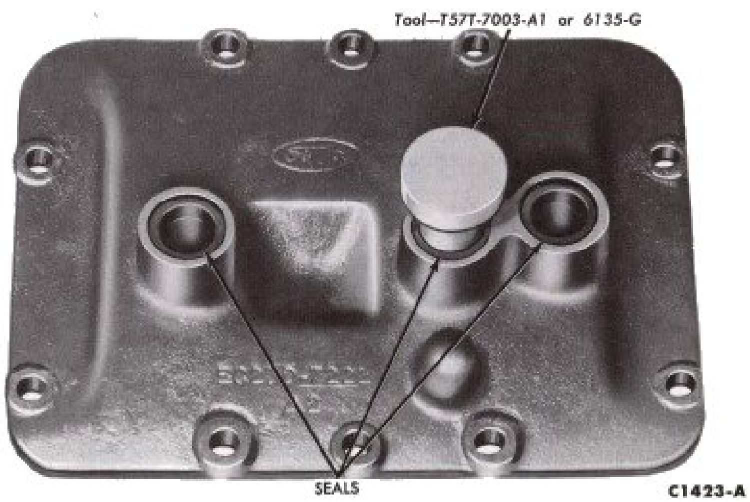


FIG. 15—Installing Cam and Shaft Seals

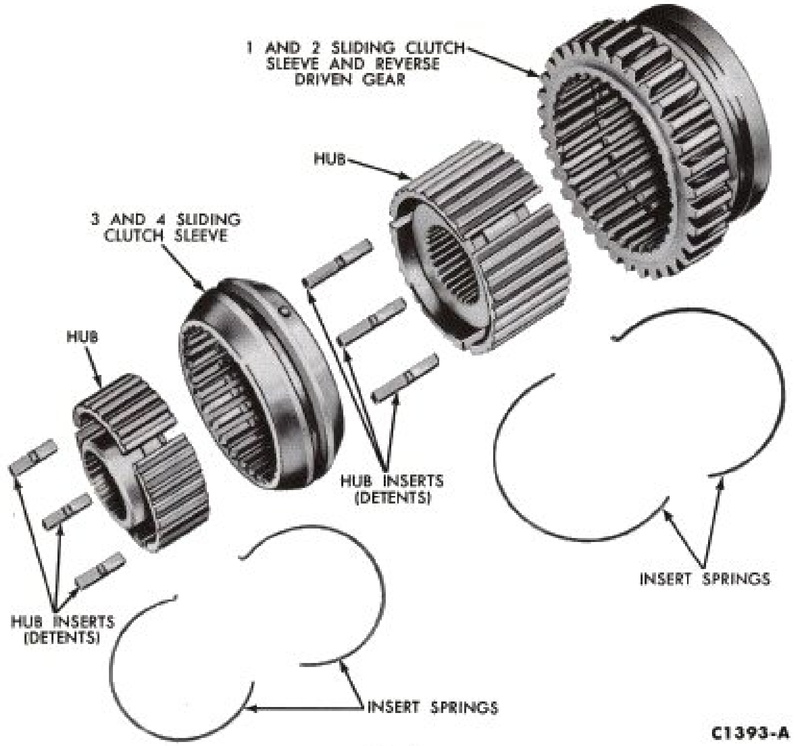


FIG. 16–Synchronizers Disassembled

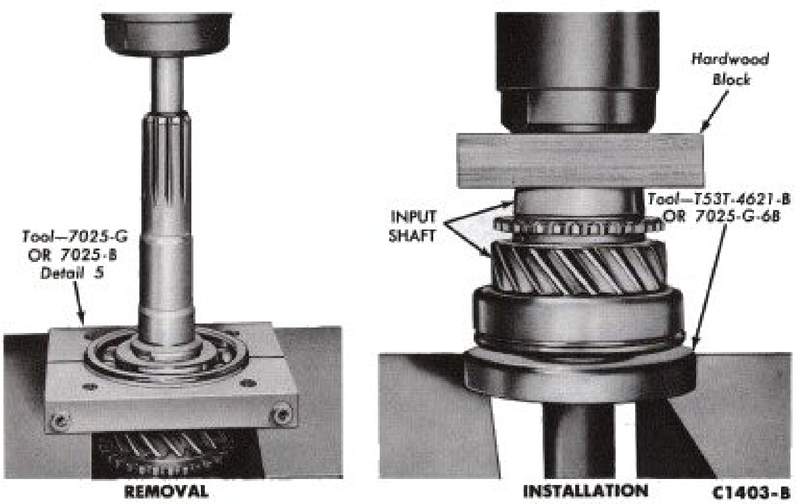


FIG. 17–Removing and Installing Input Gear Bearing

the wide thrust surface of the hub toward the rear. Align the blocking ring slots with the synchronizer inserts (detents). The hub to shaft spline fit may require a slight press to assemble.

9. Using snap ring pliers, install the snap ring in its groove on the front of the output shaft.

10. Position the countershaft gear in the case with the two thrust washers at the front. Allow the gear and tool assembly to lay in the bottom of the case until the input and output shafts are installed.

11. Using a light film of grease, install roller bearings in the bore of the input gear.

12. Install the input gear assembly in the case front bore. Place the fourth gear blocking ring on the rear of the input gear with the clutch teeth forward.

13. Enter the output shaft assembly through the rear of the case and guide the output shaft front pilot into the input gear bore and bearings (Fig. 8). Be sure the fourth gear synchronizer blocking ring slots index with the inserts (detents) on the 3-4 synchronizer assembly.

14. Raise the countershaft (cluster) gear and thrust washers until the countershaft can be inserted from the rear of the case into the gear and bearings. The shaft should push through, easily displacing the tool. Push on the shaft until it contacts the front of the case (Fig. 6). Position the flat on the rear of the countershaft in a horizontal plane so it will align with the slot in the extension housing. Tap the shaft into place.

15. Install the reverse idler gear with the fork groove toward the rear and the idler shaft flat horizontal and parallel with the countershaft flat.

16. Position a new extension housing gasket on the rear of the case, using a non-drying sealer.

17. Install the extension housing. Align the dowel in the housing with the hole in the rear bearing adapter (Fig. 19). Be sure the housing is seated squarely on the case, bearing and adapter before torquing the bolts. If two long and two short bolts are used, install the two long bolts in the upper right and lower left holes.

18. If the input gear bearing retainer seal needs replacing, refer to Fig. 21. Install the new bearing retainer gasket, using sealer. Install the bearing retainer with the drain slot facing downward. Seal and torque the bolts to specifications.

19. Place the 1-2 and 3-4 synchronizer in neutral and the reverse idler gear in reverse (forward) position.

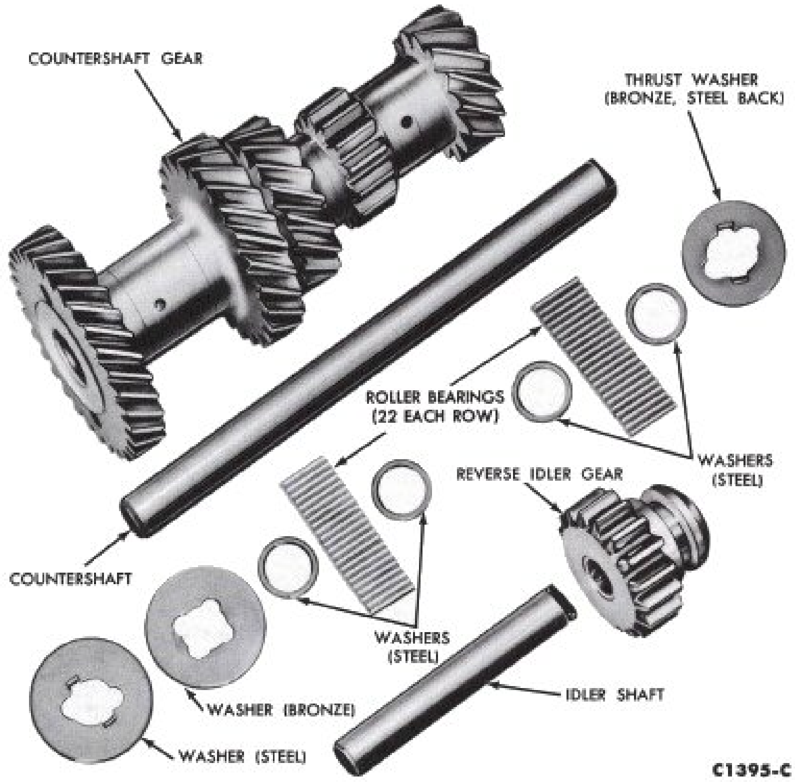


FIG. 18—Countershaft and Idler Gear Disassembled

Set the reverse shift lever in the reverse position. Install a new shift cover gasket on the case, using sealer.

Install the shift cover. Use sealer on the bolts and torque them to specifications.

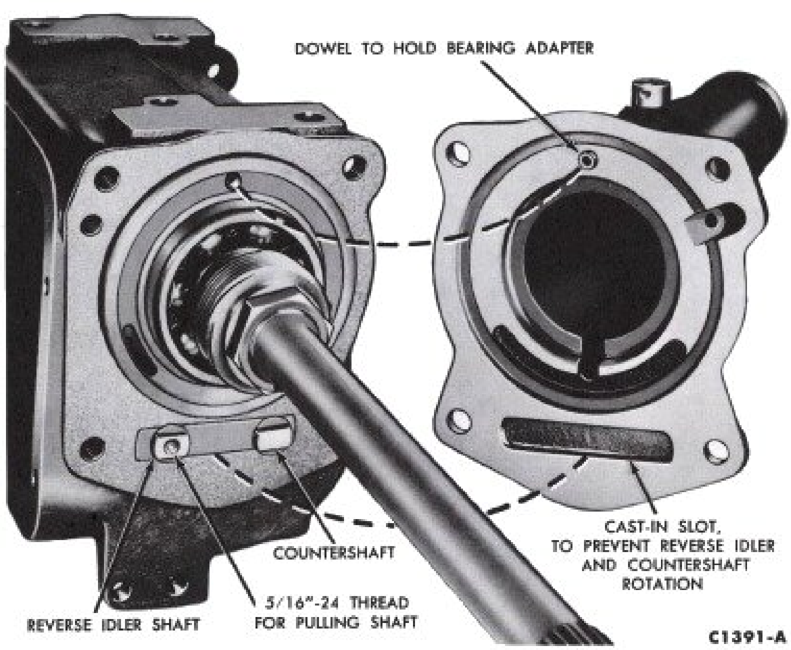


FIG. 19—Extension Housing Installation

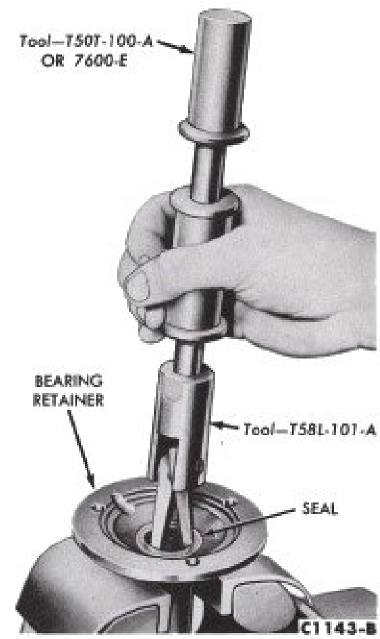


FIG. 20—Removing Input Shaft Bearing Retainer Seal

20. Install the flywheel housing. Use sealer on the retaining bolts and torque them to specifications.

21. Install the clutch release bearing on the clutch release lever. Position the release lever through the housing from inside the housing and clip the lever retainer onto its hook as shown in Fig. 5.

22. Install the shift lever selector assembly on the extension housing (Fig. 1).

23. Insert the shift rods in the cam levers and secure them with the spring washers and cotter pins or clips. Tighten the reverse cam lever nut.

24. Loosely assemble the shift rods to the linkage levers. Insert a ¼-inch rod through the three linkage levers and into the support (Fig. 4). Adjust the linkage as outlined in "Gear Shift Linkage Adjustment." Remove the ¼-inch rod.

25. Assemble the shield over the shift selector assembly.

PART 6-5 WARNER GEAR FOUR-SPEED TRANSMISSION

1 DESCRIPTION AND OPERATION

DESCRIPTION

The Warner 4-speed transmission (Fig. 1) is of the fully synchronized type with all gears except the reverse sliding gear being in constant mesh. All forward-speed changes are accomplished with synchronizer sleeves (Fig. 2) instead of sliding gears. The synchronizers will enable quicker shifts, greatly reduce gear clash, and permit down-shifting into any forward speed gear while the car is moving.

The shift linkage is mounted directly on the transmission extension housing (Fig. 1) and enters the drivers compartment through an opening in the floor pan. A flexible rubber boot is provided to seal the drivers compartment (Fig. 3) from the exterior.

The shift pattern is shown on the top of the gear shift lever knob. A finger-operated release lever is provided on the shift lever to prevent the transmission from being accidentally shifted into reverse gear. All forward speed gears in the transmission are helical-type, however, the reverse sliding gear and the reverse rear idler gears located in the extension housing are spur-type gears.

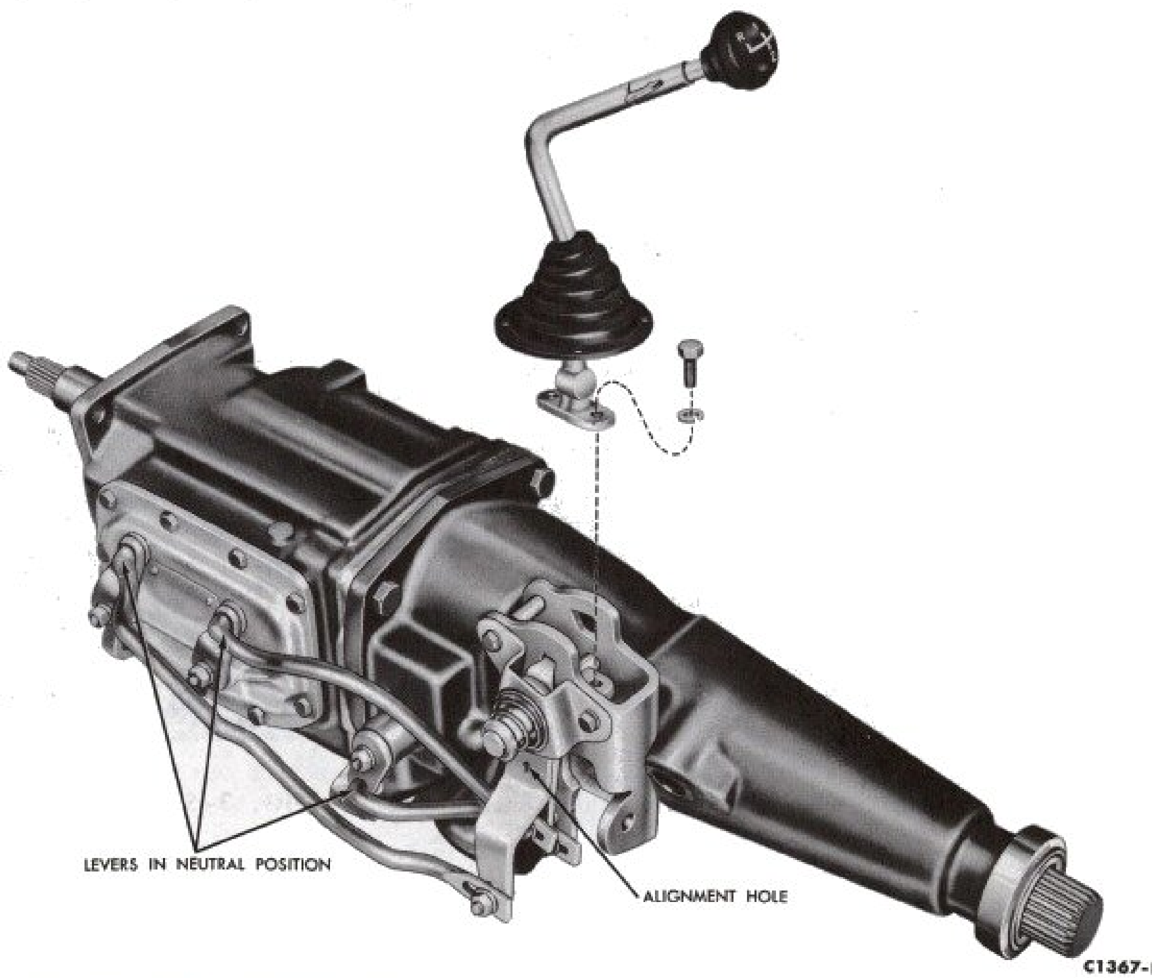


FIG. 1—4-Speed Floor Shift Transmission

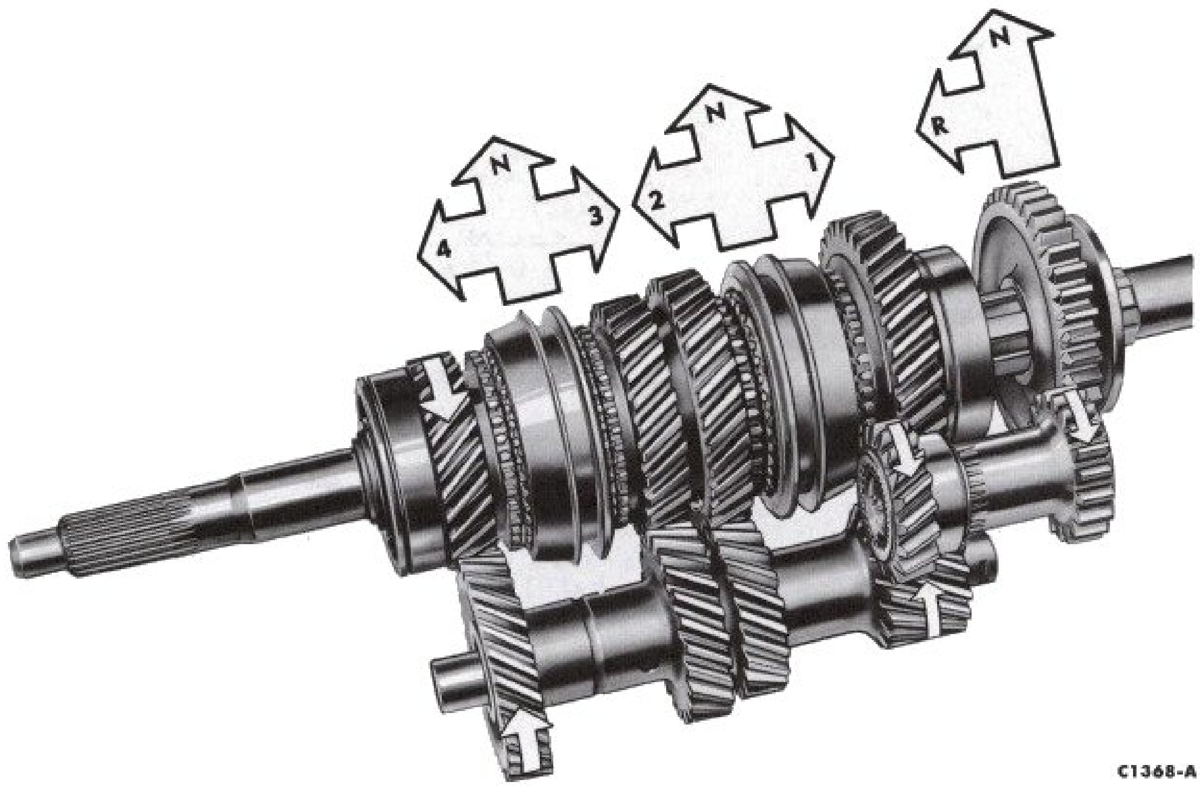


FIG. 2—Power Flow—4-Speed Transmission

OPERATION

In first speed, the first and second speed synchronizer sleeve is moved rearward by the shift fork. The sleeve engages the first speed blocking ring, which acts as a cone clutch applied to the free-wheeling first speed gear. This action speeds up or slows down the first-speed gear to match the speed of the output shaft. Further movement of the sleeve locks the first-and-second speed synchronizer hub to the first-speed gear by means of internal splines. On engagement of the clutch, power flows through the input shaft and gear to the meshed countershaft gear and thence to the first-speed gear. This gear transmits the power through the locked synchronizer hub to the transmission output shaft. All the other forward speed gears are in idler motion, as they are all driven by the countershaft (cluster) gear, but they do not transmit power because they are not locked to the output shaft. All the forward-speed shifts are made in the same manner as the first-speed shift, due to the constant-mesh features.

Reverse gear is engaged by moving the reverse sliding gear forward on the output shaft until it meshes with the reverse rear idler gear. Movement of the sliding gear is accomplished by a separate shift fork mounted in the extension housing. With all forward speed synchonizer sleeves in neutral, power flow in reverse is through the input shaft to the constant-mesh countershaft (cluster) gear, thence to the constant mesh reverse gear front idler. Splines then carry the power through the adapter plate to the reverse gear rear idler in the extension housing. As the sliding reverse gear is meshed with the reverse gear rear idler, power is transmitted to the output shaft, rotating it in a reverse direction.

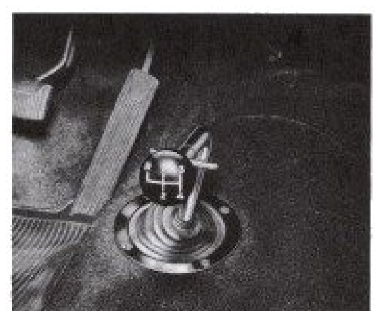


FIG. 3—Shift Lever Installation

2 IN-CAR ADJUSTMENT AND REPAIRS

GEAR SHIFT LINKAGE ADJUSTMENT

To adjust the gear shift linkage, place the shift lever in neutral position and raise the car on a hoist. Insert a ¼-inch drill or drill rod into the alignment hole as shown in Fig. 4. If the rod will not enter, check for bellied or bent shift rods. If the shift rods are the correct shape, check for loose lever lock nuts at the rod ends. Reset the linkage by loosening the three rod-retaining lock nuts (Fig. 5) and moving the levers until the ¼-inch gauge rod or drill will enter the alignment holes. Make sure the transmission shift levers are in neutral and the reverse shift lever is in the neutral detent. If there is any doubt about location of the neutral position, disconnect the shift rods at the retaining lock nuts and rotate each forward-speed shift lever through its three positions until the center (neutral) detent is positively located. Move the reverse shift lever forward until positive engagement of the detent is felt. Install the shift rods and tighten the lock nuts to specifications. Remove the ¼-inch gauge rod. Operate the shift levers to make sure that the detents are engaging. Lower the car and check for smooth cross-over operation.

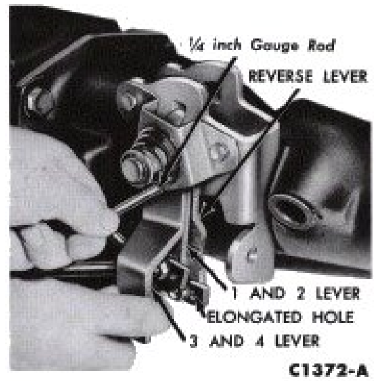


FIG. 4—Shift Linkage Adjustment

3 REMOVAL AND INSTALLATION

REMOVAL

1. Before raising the car, remove the transmission gear shift selector lever boot retainer (Fig. 5). Working under the boot, **remove the shift selector lever retaining bolts** and remove the selector lever from the shift assembly. The remaining shift linkage may be left on the transmission during removal.

2. Disconnect the drive shaft from the rear U-joint flange. Slide the drive shaft off the transmission output shaft and install the tool shown in Fig. 2, Part 6-1, to prevent lubricant leakage.

3. Disconnect the speedometer cable from the extension housing.

4. Disconnect the parking brake at the equalizer bar and support the engine with a transmission jack.

5. Remove the extension housing-to-engine rear support spring attaching bolts.

6. Raise the rear of the engine with the transmission jack. Disconnect the frame crossmember at the frame and remove the crossmember and engine rear support as a unit.

7. Support the transmission on a jack and remove the bolts that attach the transmission to the flywheel housing.

8. Move the transmission and jack rearward until the transmission input shaft clears the flywheel housing. If necessary, lower the engine enough to obtain clearance for transmission removal.

Do not depress the clutch pedal while the transmission is removed.

INSTALLATION

1. Make sure that the mounting surfaces of the transmission and the flywheel housing are free of dirt, paint, and burrs. Install two guide pins in the flywheel housing lower mounting bolt holes. Move the transmission forward on the guide pins until the input shaft splines enter the clutch hub splines and the case is positioned against the flywheel housing.

2. Install the two upper mounting bolts snug and then remove the two guide pins. Install the two lower mounting bolts. Torque all mounting bolts to specifications.

3. Raise the rear of the engine, and install the engine rear support and spring mount as a unit. Then lower the engine. Torque the rear support-to-frame attaching bolts to specifications.

4. With the transmission extension housing resting on the spring mount, install the transmission extension housing attaching bolts. Torque to specifications.

5. Connect the speedometer cable to the extension housing, and connect the parking brake cable to the equalizer.

6. Remove the tool shown in Fig. 2, Part 6-1, and slide the forward end of the drive shaft assembly over the transmission output shaft. Connect the drive shaft to the rear U-joint flange.

7. Place the shift cover levers and the reverse shift lever in neutral position and insert a ¼-inch rod in the shift linkage alignment hole. Adjust the linkage as necessary and tighten the linkage lever lock nuts to specifications. Remove the ¼-inch rod.

8. Fill the transmission to the proper level with the specified lubricant.

9. Lower the car and install the shift selector lever and boot.

10. Check the shift and cross-over motion for full shift engagement and smooth cross-over operation.

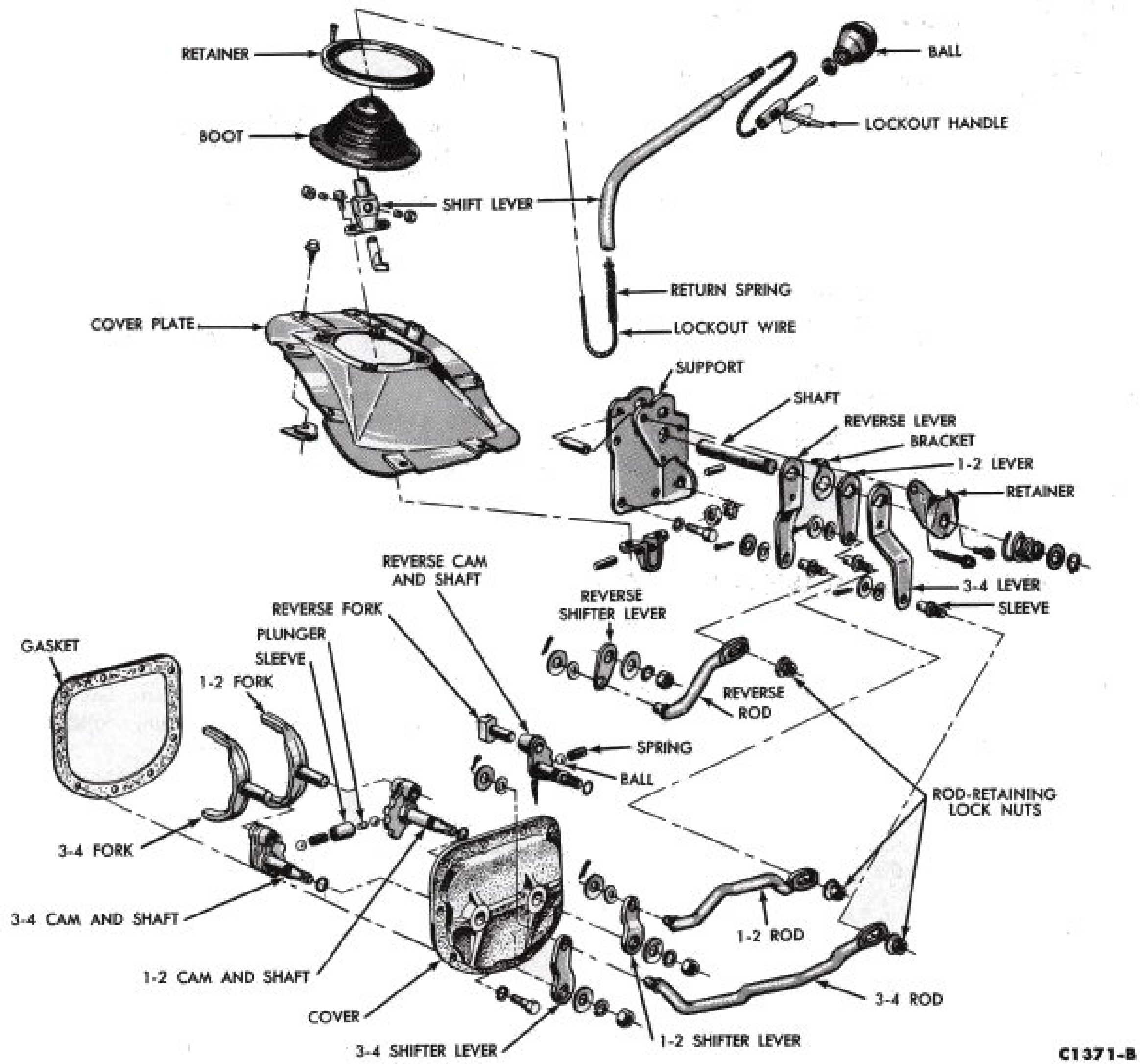


FIG. 5—Shift Linkage and Cover Disassembled

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

1. Mount the transmission in a holding fixture and drain the lubricant.

2. Disconnect the shift linkage rods at the shift levers. Remove the shift linkage from the extension housing as a unit.

3. Remove the transmission shift cover, gasket and shift forks as an assembly.

4. Drive the reverse shift shaft pin (Fig. 6) out of the extension housing. Move the reverse shift shaft out of the extension housing about ⅛-inch. This operation frees the reverse shift fork from the reverse sliding gear located in the extension housing.

5. Remove the extension-to-case attaching bolts (Fig. 7). Tap the extension housing with a soft hammer to free it from the case. Slide the extension housing rearward until the reverse idler shaft (Fig. 8) is clear of the reverse rear idler gear. Rotate the extension housing to the left to clear the reverse shift fork and remove the extension housing.

6. Lift the reverse gear rear idler (Fig. 9) from the case.

7. Remove the self-locking bolt that attaches the adapter plate to the transmission case. Remove the transmission output shaft assembly along with the adapter plate (Fig. 10). Catch any of the input shaft pilot rollers that may stick to the output shaft. Remove the remaining rollers from the input shaft bore.

8. Remove the fourth-speed gear synchronizer blocking ring which will be stuck on the input shaft gear or will have fallen into the case.

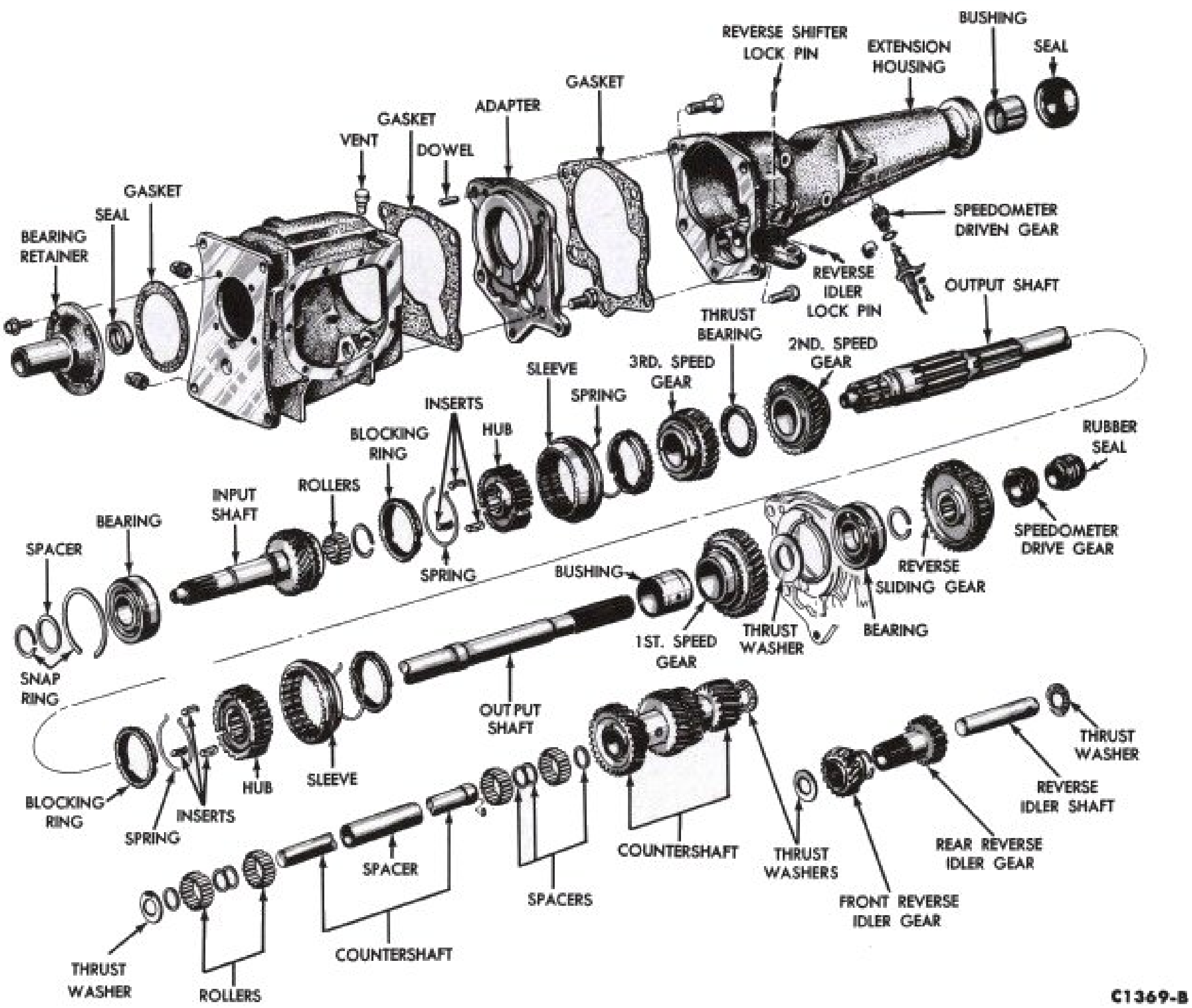


FIG. 7—4-Speed Transmission Disassembled

9. Remove the reverse gear front idler and thrust washer from the case (Fig. 11).

10. Working from the front of the case, use a drift to start the countershaft rearward. Insert the tool (dummy shaft) shown in Fig. 12 and push out the countershaft, allowing the countershaft (cluster) gear to settle to the bottom of the case. Remove the Woodruff key from the rear of the countershaft.

11. Remove the input shaft bearing retainer and discard the gasket. Remove the input shaft bearing retaining snap ring and push the input shaft and bearing assembly inward and out of the bearing bore. Remove the input shaft assembly from inside the case.

12. Remove the countershaft (cluster) gear from the case (including dummy shaft and thrust washers). Note the arrangement of the spacers.

13. Remove the input shaft bearing retainer oil seal as shown in Fig. 13.

14. Install the input shaft bearing retainer oil seal using the tool shown in Fig. 14.

15. To disassemble the output shaft, remove the small snap ring at the front of the shaft and slide the third and fourth-speed gear synchronizer assembly (Fig. 15), third-speed gear synchronizer blocking ring, third-speed gear (Fig. 16), thrust washer, second-speed gear, and second-speed synchronizer blocking ring (Fig. 17) off the shaft.

16. Remove the output shaft rear oil seal from the shaft. Position the output shaft in a press and remove the speedometer drive gear (Fig. 18). Slide the reverse sliding gear off the output shaft.

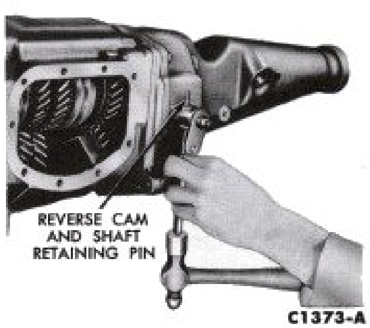


FIG. 6—Removing Reverse Cam and Shaft Retaining Pin

17. Spread the retaining snap ring (Fig. 19) and press or tap the

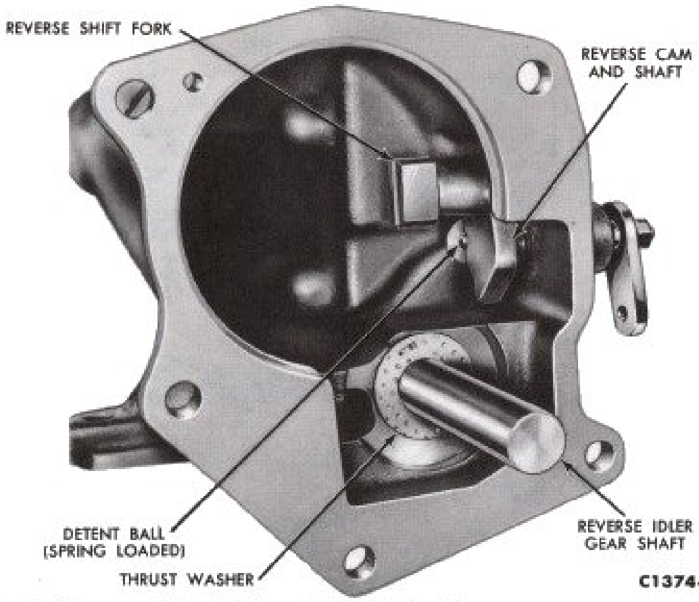


FIG. 8—Reverse Idler Shaft and Shift Mechanism

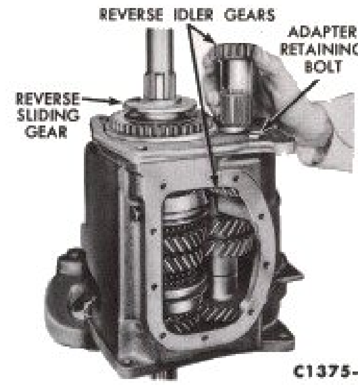


FIG. 9—Reverse Gear Rear Idler Removal

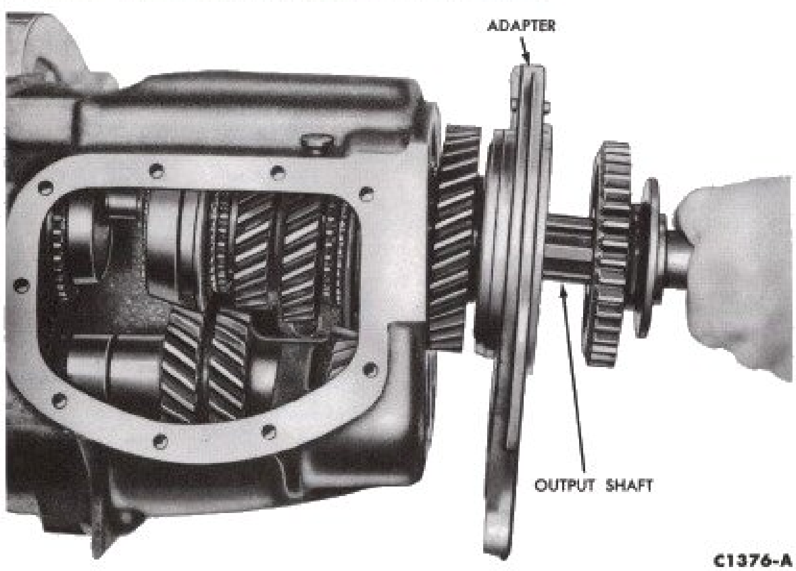


FIG. 10—Output Shaft Removal

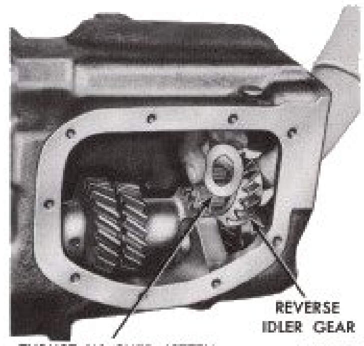


FIG. 11—Reverse Gear Front Idler Removal

FIG. 12—Countershaft Removal

adapter plate off the output shaft rear bearing. Remove the snap ring retaining the output shaft bearing to the output shaft and press the bearing off the shaft (Fig. 20).

18. Complete the disassembly of the output shaft by sliding off the first-speed gear thrust washer (plain), first-speed gear, first-speed gear bushing, first-speed synchronizer blocking ring and first and second-speed synchronizer assembly (Fig. 20).

19. To disassemble the extension housing, first remove the oil seal as shown in Fig. 1, Part 6-1. If necessary to replace the extension housing bushing, do so after reinstalling the extension housing, so that the tool shown in Fig. 2, Part 6-1, will be supported by the output shaft.

20. Pull the reverse shift fork from the reverse shift shaft and cam. Remove the reverse shift lever and carefully tap the shaft and cam into the housing, allowing the detent ball and spring to drop out of the detent bore. Remove the "O"-ring seal from the shift shaft.

21. Remove the reverse idler shaft by driving the retaining pin inward until it bottoms. Pull the shaft from the extension housing. Tap the shaft with a soft-faced hammer to loosen it if necessary.

PARTS REPAIR OR REPLACEMENT

SYNCHRONIZERS

1. Scribe an index mark across the sleeve and the hub so that they may be installed in their original

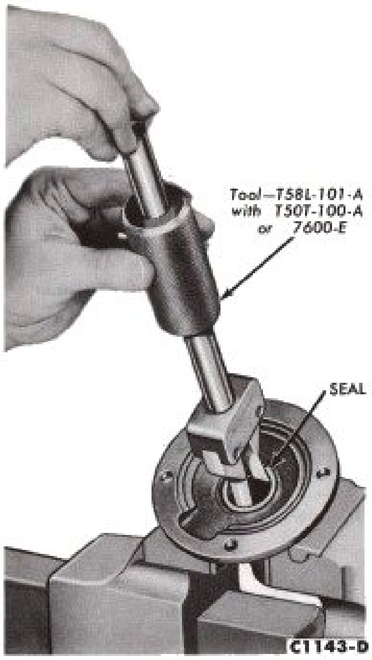


FIG. 13—Input Shaft Oil Seal Removal

FIG. 14—Input Shaft Oil Seal Installation

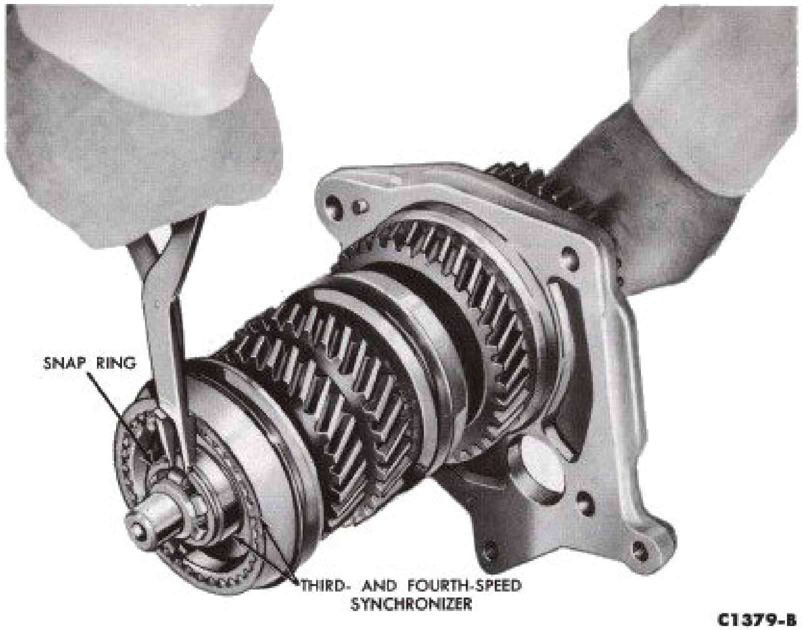


FIG. 15—Third and Fourth-Speed Synchronizer Removal

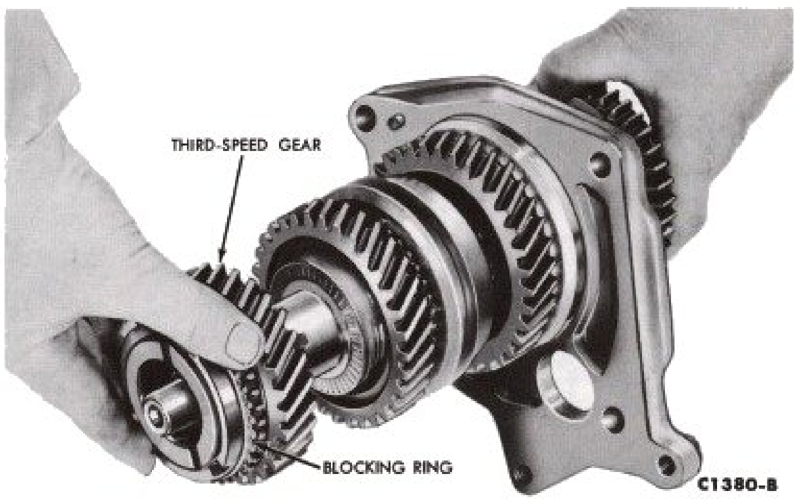


FIG. 16—Third-Speed Gear Removal

position when assembling them.

2. Disassemble the first and second speed and third and fourth-speed synchronizers (Fig. 7) by sliding the clutch sleeves off the hubs and removing the three inserts and two insert springs from each assembly.

3. In both units, the synchronizer is assembled by installing two insert springs and three inserts on the synchronizer hub.

4. The springs should be assembled with one tang of each spring in the same insert, but the springs turned in opposite directions so that the openings do not line up.

5. Line up the etched marks on the sleeves and hub and slide the sleeve onto the hub.

SHIFT COVER

1. Remove the shift levers (Fig. 5) from the cam and shaft assemblies.

2. Pull the shift forks and shafts out of the gear shift cover. With the shafts removed, the detent balls, retainer, and spring will fall out of the gear shift cover.

3. Pull the shifter forks out of the cams.

4. Remove the seal rings from the cam shafts.

5. Install new seal rings on the shift lever cam shafts. Lubricate the seal rings and shaft bores in the cover.

6. Position one cam and shaft in the cover and place it in the neutral position.

7. Install the interlock spring, sleeve, pin, and one detent ball in the shift cover detent bore (Fig. 5).

8. Position the remaining detent

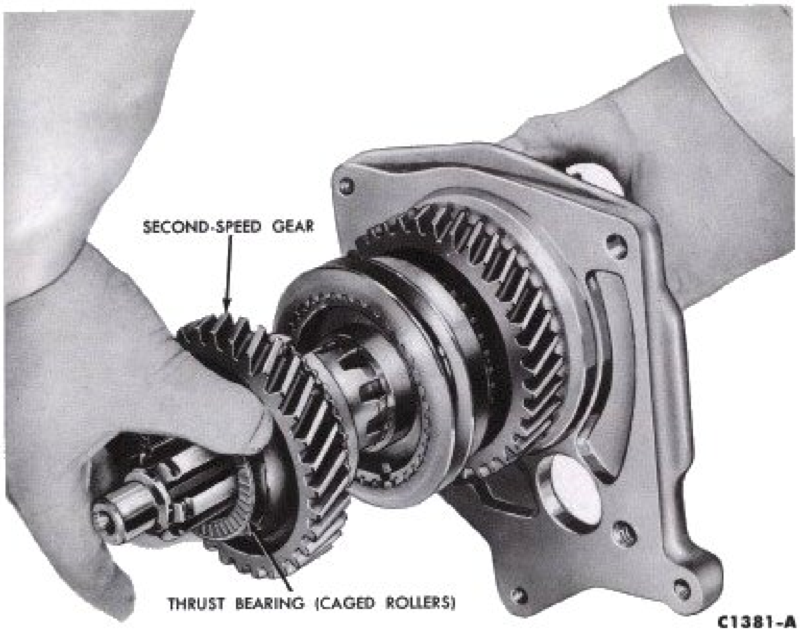


FIG. 17—Second-Speed Gear Removal

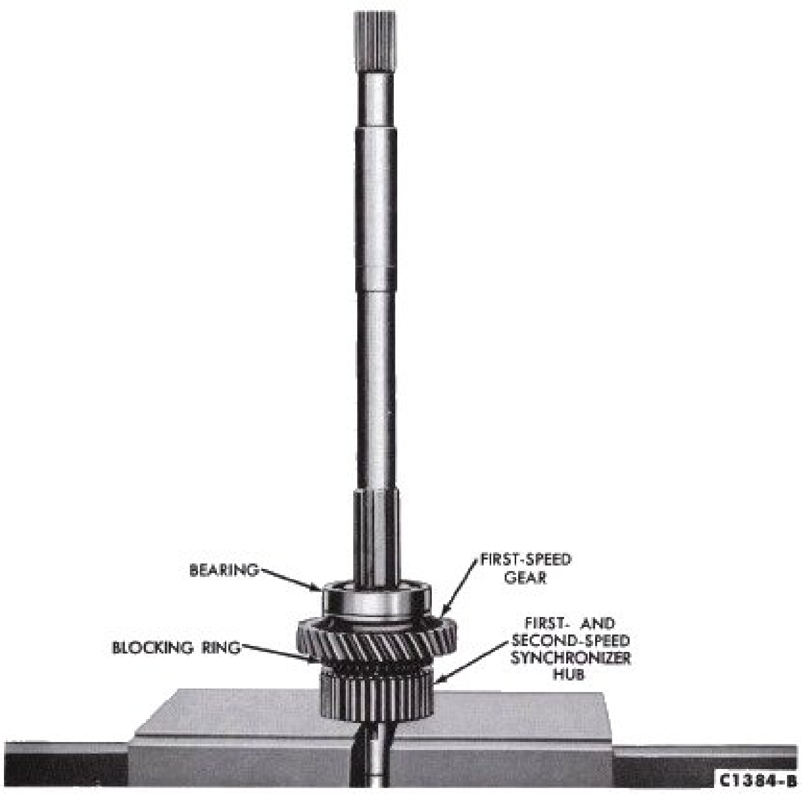


FIG. 20—Output Shaft Bearing Removal

ball and second cam and shaft in the cover. Install the gear shift levers and forks on the shafts. Check operation of the assembly.

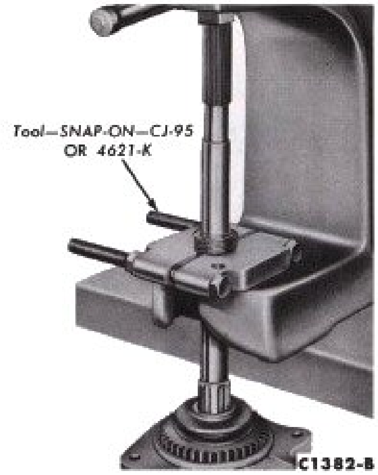


FIG. 18—Speedometer Drive Gear Removal

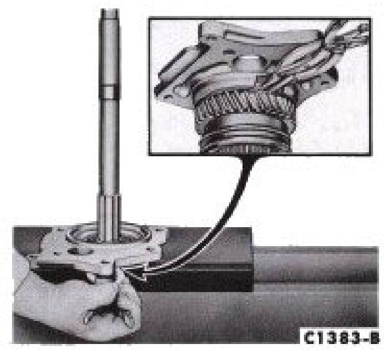


FIG. 19—Adapter Plate Removal

COUNTERSHAFT GEAR BEARINGS

1. Disassemble the countershaft gear as shown in Fig. 21. The six steel spacer washers are interchangeable.
2. Position the long countershaft roller spacer on the remover tool (dummy shaft) and install it in the countershaft (cluster) gear.
3. Install 20 roller bearings, two spacer washers, 20 more roller bearings, one spacer, and one thrust washer in each end of the countershaft gear (Fig. 21).
4. Install the thrust washers with the flat bronze sides toward the countershaft gear faces.

INPUT SHAFT BEARING

1. To disassemble the input shaft on a Falcon transmission, remove the bearing retainer snap ring, and spacer washer. Reinstall the bearing

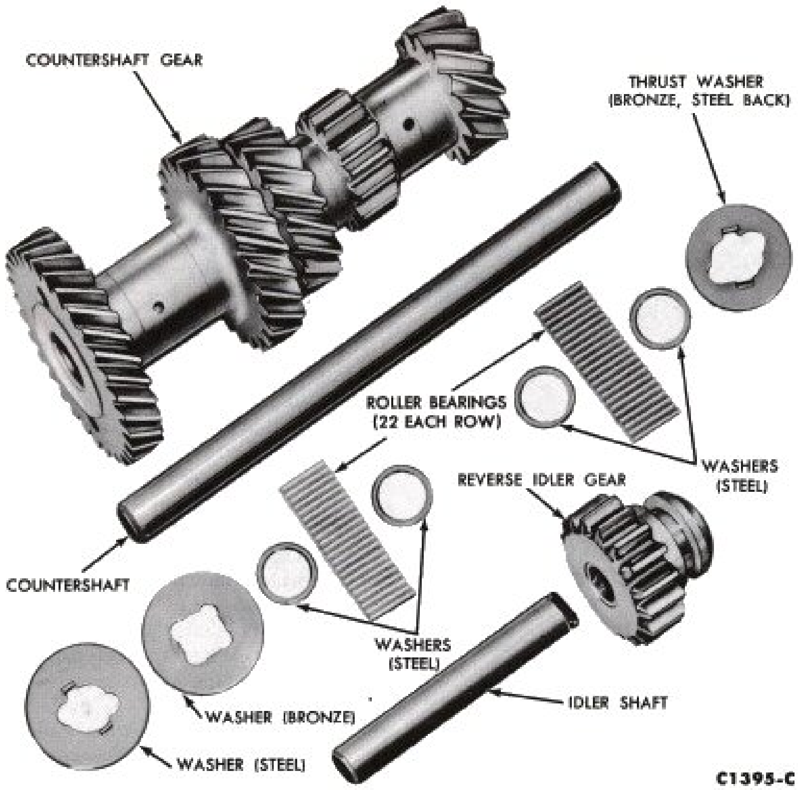


FIG. 21—Countershaft and Idler Gear Disassembled

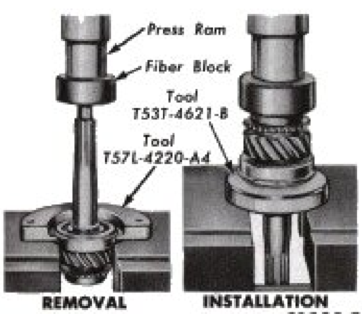


FIG. 22—Input Shaft Bearing Replacement

outer snap ring that was removed previously, then, press the bearing off the shaft as shown in Fig. 22, using the tool indicated. To disassemble the input shaft on a Comet transmission, remove the bearing retainer snap ring, and spacer washer. Insert the lip of the tool in the bearing snap ring groove and press the shaft out of the bearing.

2. Assemble the input shaft bearing on the input shaft as shown in Fig. 22. Retain the bearing on the shaft with a spacer and snap ring.

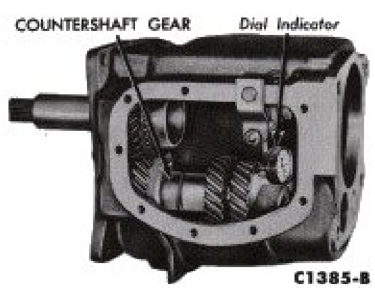


FIG. 23—Checking Countershaft Gear End Play

3. Position the input shaft pilot rollers in the input shaft bore using a light film of heavy grease.

ASSEMBLY

1. Place the countershaft gear in the case, aligning the thrust washer tangs with the slots in the case. Install the countershaft and check the countershaft gear end play (Fig. 23). Replace the thrust washers as required so that end play does not exceed 0.025-inch. Insert the remover tool in place of the countershaft and allow the countershaft gear to rest on the bottom of the case.

2. Install the input shaft assembly in the case, working through the shift cover opening. Install the input shaft assembly retaining snap ring in the front bearing groove.

3. Raise the countershaft gear into mesh with the input shaft gear and install the countershaft. Line up the countershaft Woodruff key slot with the counterbore provided in the case and install the Woodruff key. Tap the countershaft into position flush with the rear face of the case.

4. Position the fourth-speed synchronizer blocking ring on the input shaft gear taper with heavy grease.

5. Working from the rear of the output shaft, slide the first and second-speed synchronizer onto the shaft. The sliding clutch sleeve long taper should face the rear (Fig. 19).

6. Slide the first-speed gear bushing onto the output shaft. Position the first-speed gear synchronizer blocking ring on the first and second-speed gear synchronizer, aligning the notches in the blocking ring with the inserts in the synchronizer. Install the first-speed gear on the first-speed gear bushing, tapered hub facing forward. Install the first-speed gear thrust washer, with the grooved side to the gear (Fig. 7).

7. Position the output shaft rear bearing on the output shaft with the snap ring groove in the bearing race facing forward. Press the bearing on the shaft. Seat the bearing firmly against the shaft shoulder and install the retaining snap ring.

8. Install the adapter plate on the output shaft rear bearing by spreading the snap ring in the adapter plate and tapping or pressing the plate over the bearing (Fig. 19). Release the snap ring.

9. Position the reverse sliding gear on the output shaft, with the shift collar toward the rear. Press the speedometer drive gear on the output shaft until the measurement from the rear end of the output shaft to the rear face of the speedometer gear is 8$^{11}/_{16}$ inches.

10. Working from the front of the output shaft (Fig. 17), position the second-speed gear synchronizer blocking ring on the previously installed first and second-speed synchronizer. Line up the notches in the blocking ring with the inserts in the synchronizer.

11. Slide the second-speed gear onto the output shaft, with the tap-

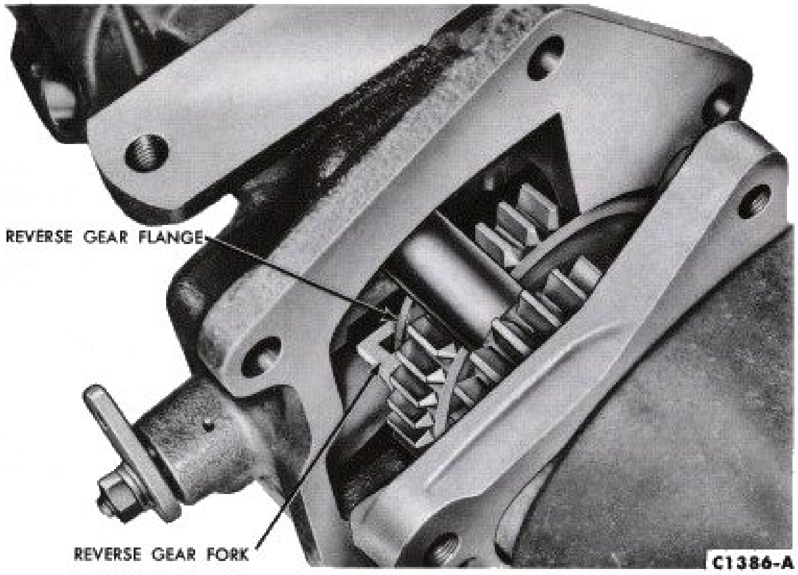


FIG. 24—Extension Housing Installation

ered hub facing toward the rear. Position the radial roller thrust bearing against the front hub face of the second-speed gear (Fig. 17).

12. Install the third-speed gear on the output shaft, with the tapered hub facing forward. Position the third-speed gear synchronizer blocking ring on the taper of the third-speed gear, with the notches in the blocking ring facing forward (Fig. 16).

13. Position the third and fourth-speed gear synchronizer assembly on the output shaft, lining up the synchronizer insert with the notches in the third-speed gear blocking ring. Install the output shaft front snap ring (Fig. 15).

14. Position the output shaft seal on the output shaft.

15. Working through the output shaft opening, install the reverse gear front idler and thrust washer in the case as shown in Fig. 11.

16. Make sure that the fourth-speed synchronizer blocking ring is in place on the input shaft gear and that the input shaft pilot rollers are installed. Apply a gasket to the rear of the case. Position the output shaft in the transmission case and move it forward, lining up the notches in the fourth-speed blocking ring with the inserts in the third and fourth-speed synchronizer. Line up the dowel pin in the adapter with the locating hole in the main case and push or tap the output shaft and adapter into position. Install the self-locking bolt retaining the adapter plate to the transmission case and torque it to specifications.

17. Install the reverse gear rear idler gear (Fig. 9).

18. Line up the retaining pin holes in the idler shaft and housing and tap the reverse idler shaft into the extension housing with a soft hammer. Coat the retaining pin with oil resistant sealer and install the pin flush with the outside of the housing.

19. Position the "O"-ring seal on the reverse shifter shaft. Install the detent ball and spring in the detent bore. Working from inside the extension housing, hold the detent ball down with a suitable tool and insert the shift shaft and cam from the inside. Install the reverse shift lever. Position the reverse shift fork on the reverse shift shaft (Fig. 8).

20. Install the reverse idler gear tanged thrust washer on the idler shaft with the tang gear facing rearward (Fig. 8). Apply heavy grease to retain the washer against the extension housing.

21. Position a new gasket on the adapter, using sealer to hold the gasket in place.

22. Move the reverse shift lever to bring the shift fork to the extreme forward position (Fig. 8). Pull the lever outward so that the reverse fork will clear the reverse gear on assembly. Slide the reverse gear forward on the output shaft until it engages the reverse idler gear.

23. Position the extension housing over the output shaft and carefully push the housing forward. Insert the reverse idler shaft into the reverse idler gears. When the reverse shift fork seats in the reverse gear shift collar groove (Fig. 24), push the reverse shift shaft into position. Move the reverse gear rearward with the shift lever, and seat the extension housing against the adapter plate.

24. Place the 1-2 and the 3-4 synchronizer in neutral and the reverse idler gear in reverse (forward) position. Set the reverse shift lever in the reverse position. Install a new shift cover gasket on the case, using sealer. Install the shift cover. Use sealer on the bolts and torque them to specifications.

25. Check the operation of the reverse shift lever. If satisfactory, install the extension housing to the adapter plate and transmission case. Apply sealer to the lower right bolt to prevent lubricant leaks. Torque to specifications.

26. Install the reverse shifter cam and shaft locking pin (Fig. 6).

27. Install the extension housing bushing and oil seal as shown in Figs. 4 and 2, Part 6-1.

PART 6-6 SPECIFICATIONS

THREE-SPEED TRANSMISSION—2.77

GEAR RATIOS

Engine	Gear			
	First Speed	Second Speed	Third Speed	Reverse
144 C.I.D.	3.29	1.75	1.00:1	4.46
170 C.I.D.	3.29	1.83	1.00:1	4.46

TORQUE LIMITS

Description	Ft-Lbs.
Extension Housing Bolts—7/16-14	37-42
—3/8-16	28-38
Input Shaft Bearing Retainer to Transmission Case Bolts	12-15
Transmission to Flywheel Housing Bolts	32-36
Transmission Cover to Transmission Case Bolts	10-13
Engine Rear Support to Extension Housing Bolt	18-24
Engine Rear Support to Extension Housing Bracket Nut	18-24
Gear Shift Levers to Cam and Shaft Assembly Lock Nuts	12-15

CLEARANCES

	Inches
Cam Ramp to Interlock Shift Sleeve—Clearance	0.001-0.013
(5) Interlock Shift Sleeves Available—Length	1.286-1.288
Countershaft Gear End Play	0.0045-0.0185

LUBRICANT

Type Lubricant	Mild EP Gear Oil M-568-D
Capacity	2½ pints

THREE-SPEED TRANSMISSION—3.03

GEAR RATIOS

Car Usage	Transmission Model	Engine C.I.D.	Ratio			
			First Speed	Second Speed	Third Speed	Reverse
Falcon-Comet	HEF-N	260-2V	2.79	1.70	1.00:1	2.87

TORQUE LIMITS

Description	Ft-Lbs.
Input shaft bearing retainer to transmission case	19-25
Extension housing to transmission case	42-50
Access cover to transmission case	14-19
Gear shift control levers to cam and shaft	18-23
Shift fork to shift rail	12-17
Filler plug to case	10-15
Drain plug to case	20-30
Detent set screw (special)	*

*Flush to 0.020 inches below top of case

CLEARANCES

Description	Inches
Countershaft Gear End Play	0.004-0.018
Reverse Idler Gear End Play	0.004-0.018

LUBRICANT

Type Lubricant	Mild EP Gear Oil M-568-D
Capacity	3½ pints

DAGENHAM FOUR-SPEED TRANSMISSION

GEAR RATIOS

Engine	First Speed	Second Speed	Third Speed	Fourth Speed	Reverse
144 and 170 C.I.D.	3.162	2.214	1.412	1.00:1	3.346

CLEARANCES

Description	Inches
Countershaft Gear End Play	0.008-0.020

LUBRICANT

Type Lubricant	Mild EP Gear Oil M-568-D
Capacity	4.8 Pints

WARNER FOUR-SPEED TRANSMISSION

TORQUE LIMITS

Description	Ft-Lbs.
Adapter Plate to Extension Housing Bolts	20-30
Engine Rear Support to Extension Housing Bolts	35-40
Gear Shift Control Levers to Cam and Shaft Assembly	12-15
Gear Shift Housing to Transmission Case Bolts	15-20
Gear Shift Linkage to Transmission Extension Housing Bolts	12-15
Input Shaft Bearing Retainer Bolt	15-20
Third Crossmember to Support Bracket Bolts	45-50
Transmission to Extension Housing Bolts	35-45

CLEARANCES

Description	Inches
Countershaft Gear End Play	0.025

LUBRICANT

Type Lubricant	Mild EP Gear Oil M-568-D
Capacity (Dry)	3½ pints

AUTOMATIC TRANSMISSION — GROUP 7

PART 7-1 GENERAL TRANSMISSION SERVICE

Part 7-1 covers diagnosis and testing, common adjustments and repairs, and cleaning and inspection for both the C4 Automatic dual range and the Fordomatic or Mercomatic single range transmissions. Where there are differences in specifications or procedures, the type of transmission affected will be designated.

1 DIAGNOSIS AND TESTING

When transmission trouble is indicated, the following preliminary checks should be made in the order given.

1. Check the fluid level. Check the fluid for a burnt clutch plate odor.

2. Check the engine idle speed and dashpot adjustments.

3. Check the manual linkage adjustment.

4. Check the accelerator pedal height and downshift linkage.

5. Check the throttle linkage to assure wide open throttle operation.

6. Check the engine for proper operation.

TRANSMISSION FLUID LEVEL CHECK

1. Make sure that the car is standing level. Then firmly apply the parking brake.

2. Run the engine at normal idle speed. If the transmission fluid is cold, run the engine at fast idle speed (about 1200 rpm) until the fluid reaches its normal operating temperature. When the fluid is warm, slow the engine down to normal idle speed.

3. Shift the selector lever through all positions and place the lever at P. Do not turn off the engine during the fluid level checks.

4. Clean all dirt from the transmission fluid dipstick cap before removing the dipstick from the filler tube.

5. Pull the dipstick out of the tube, wipe it clean, and push it all the way back into the tube.

6. Pull the dipstick out of the tube again and check the fluid level. If necessary, add enough fluid to the transmission through the filler tube to raise the fluid level to the F (Full) mark on the dipstick. **Do not overfill the transmission.**

FLUID AERATION CHECK

Fluid foaming will cause erratic operation and, in extreme cases, will force the fluid out the vent. Fluid foaming can be caused by overfilling the transmission, improper fluid used, or by water from the cooling system getting into the transmission fluid. Fluid foaming can also be caused by the pump aerating the fluid. This happens when the pump sucks air along with the fluid. When the fluid is depressurized, the air expands and blows bubbles in the fluid.

On a Fordomatic or Mercomatic Transmission, follow this procedure to determine which pump is sucking the air:

1. Run the engine until the transmission is at normal operating temperatures.

2. Remove the transmission dipstick and install a funnel in the filler tube.

3. Remove the converter-out line from its fitting on the lower right-hand side of the transmission case (Fig. 1). Remove the fitting from the case. Attach a hose and fitting to the converter-out ⅛-inch pipe thread in the transmission case.

4. Fasten the free end of the hose to the funnel in the filler tube.

5. Firmly apply the parking brake so that the rear wheels do not turn. This keeps the rear pump from turning.

6. Start the engine and run it at 700 rpm with the transmission in N.

7. Observe the fluid flow at the funnel in the filler tube. If the front pump is sucking air, the flow at the funnel will spit much the same as a

bleeding brake line which has air in it. If the front pump is not sucking air, the flow will be like the flow from a bleeding brake line which has no air in it (a "solid" flow).

8. To check the rear pump, the rear wheels must turn. Block the front wheels securely and raise the rear axle on a hoist, or support it on stands. Place the selector lever at D and increase the engine speed until the speedometer reads 50 mph.

9. If the flow at the funnel is spitting now and the flow was normal when only the front pump was running, the rear pump is sucking air. If, however, the flow was spitting when only the front pump was running and the flow is normal at speeds above 50 mph, the front pump is sucking air and the rear pump is not.

Transmission pumps will suck air if the normal fluid intake is restricted, for example, by a clogged screen. When the restriction is removed, the pumps will no longer suck air.

TRANSMISSION FLUID LEAKAGE CHECKS

Check the speedometer cable connection at the transmission. Leakage at the oil pan gasket often can be stopped by tightening the attaching bolts to the proper torque. If necessary, replace the gasket. Check the fluid filler tube connection at the transmission.

If the transmission fluid is water cooled, check the fluid lines and fittings between the transmission and the cooler in the radiator tank for looseness, wear, or damage. If leakage cannot be stopped by tightening a fitting, replace the leaking parts.

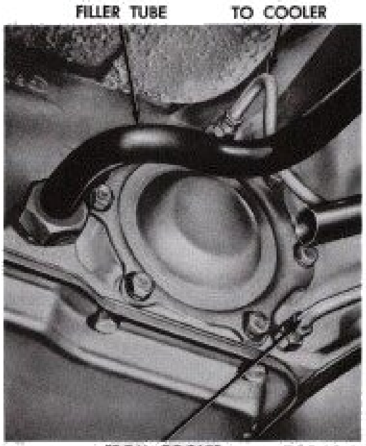


FIG. 1—Typical Cooler Line Connections at Transmission

Check the engine coolant in the radiator. If transmission fluid is present in the coolant, the cooler in the radiator tank is probably leaking.

The cooler can be further checked for leaks by disconnecting the lines from the cooler fittings and applying 5 psi air pressure to the fittings. If the cooler is leaking and will not hold this pressure, the radiator must be replaced. **The cooler cannot be replaced separately.**

If leakage is found at either the throttle lever shaft or the manual lever shaft, replace either or both seals.

Inspect the pipe plug in the case. If the plug shows leakage, torque the plug to specification. If tightening does not stop the leaks, replace the plug.

When converter drain plugs leak, remove the two drain plugs with a six-point wrench. Coat the threads with FoMoCo Perfect Seal Sealing Compound or its equivalent, and install the plugs. Torque the drain plugs to specifications. **Fluid leakage from the converter housing may be caused by engine oil leaking past the rear main bearing or from oil gallery plugs. Be sure to determine the exact cause of the leak.**

Oil-soluble aniline or fluorescent dyes premixed at the rate of ½ teaspoon of dye powder to ½ pint of transmission fluid have proved helpful in locating the source of the fluid leakage. Such dyes may be used to determine whether an engine oil or transmission fluid leak is present, or if the fluid in the oil cooler leaks into the engine coolant system. A black light, however, must be used with the fluorescent dye solution.

OIL LEAKAGE IN CONVERTER AREA

In diagnosing and correcting fluid leaks in the front pump and converter area, use the following procedures to facilitate locating the exact casue of the leakage. Leakage at the front of the transmission, as evidenced by oil around the converter housing, may have several sources. By careful observation, it is possible, in many instances, to pinpoint the source of the leak before removing the transmission from the car. The paths which the fluid takes to reach the bottom of the converter housing are shown in Fig. 2.

1. Fluid leaking by the seal lip will tend to move along the drive hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the converter housing only, near the outside diameter of the housing (Fig. 2).

2. Fluid leakage by the outside diameter of the seal and front pump body will follow the same path which leaks by the front pump seal or may run down the face of the front pump.

3. Fluid that leaks by a front pump to case bolt will be deposited on the inside of the converter housing only. Fluid will not be deposited on the back of the converter.

4. Leakage by the front pump to case gasket may cause fluid to be deposited inside the converter housing as shown in Fig. 2.

5. Fluid leakage from the converter drain plugs will appear at the outside diameter of the converter.

Engine oil leaks are sometimes improperly diagnosed as front pump seal leaks. The following areas of possible leakage should also be checked to determine if engine oil leakage is causing the problem.

1. Leakage at the rocker arm cover (valley cover) may allow oil to flow over the converter housing or seep down between the converter housing and engine block causing oil to be present in or at the bottom of the converter housing.

2. Oil gallery plug leaks will allow oil to flow down the rear face of the block to the bottom of the converter housing.

3. Leakage by the crankshaft seal will work back to the flywheel, and then into the converter housing.

Fluid leakage from other areas such as the power steering system, forward of the transmission, could cause fluid to be present around the converter housing due to blow back or road draft.

The following procedure should be used to determine the cause of the leakage before any repairs are made.

1. Remove the transmission dipstick and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transmission. Unless a considerable amount of "make-up" fluid has been added or the fluid has been changed, the red

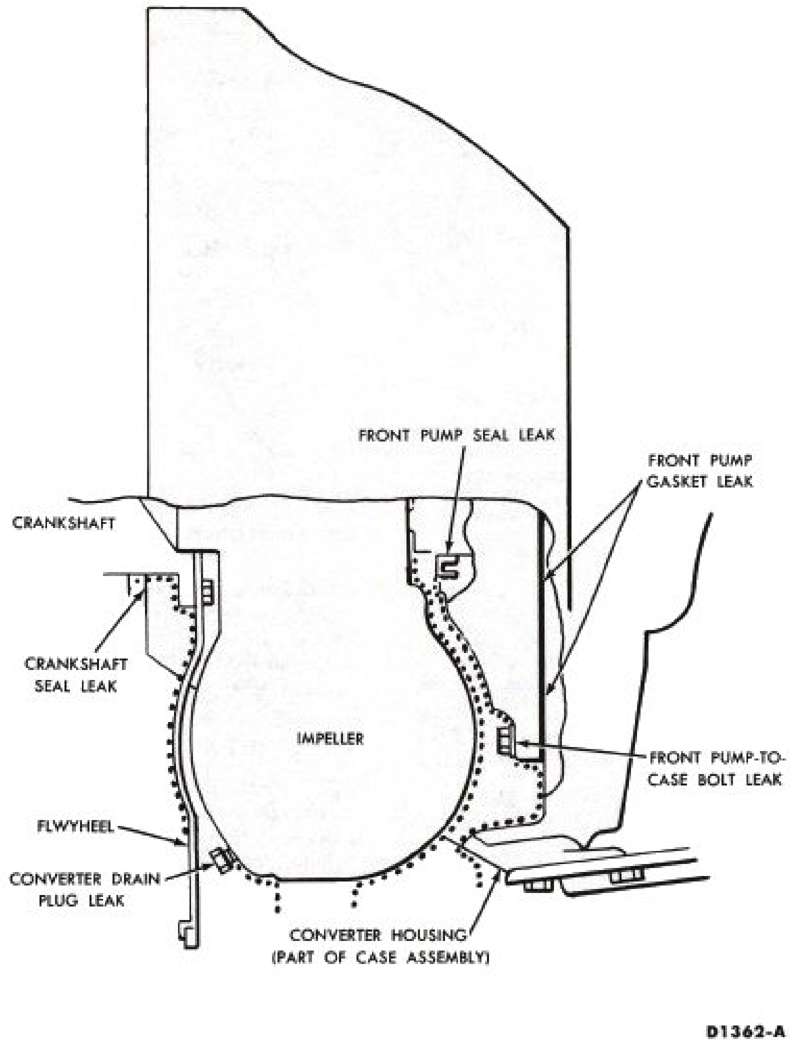


FIG. 2–Typical Converter Area Oil Leakage Checks

color should assist in pinpointing the leak. Fluid used in the power steering system is also dyed red. Since road draft may cause leaking power steering fluid to be present on the transmission, this leakage, if present, should be eliminated before performing work on the transmission.

2. Remove the lower converter housing cover. Clean off any fluid from the top and bottom of the converter housing, front of the transmission case, and rear face of the engine and engine oil pan. Clean the converter area by washing with carbon tetrachloride or other suitable nonflammable solvent, and blow dry with compressed air.

3. Wash out the converter housing, the front of the flywheel, and the converter drain plugs. The converter housing may be washed out using cleaning solvent and a squirt-type oil can. Blow all washed areas dry with compressed air.

4. Start and run the engine until the transmission reaches its normal operating temperature. Observe the back of the block and top of the converter housing for evidence of fluid leakage. Raise the car on a hoist and run the engine at fast idle, then at engine idle, occasionally shifting to the drive and reverse ranges to increase pressures within the transmission. Observe the front of the flywheel, back of the block (in as far as possible), and inside the converter housing (Fig. 2). Run the engine until fluid leakage is evident and the probable source of leakage can be determined.

CONVERTER LEAKAGE CHECK

During the above fluid leakage checks, if there are indications that the welds on the torque converter housing are leaking, the converter will have to be removed and the following check made before the unit is replaced.

A leak checking tool (Fig. 3) can be made from standard parts.

1. Install the plug in the converter (Fig. 4) and expand it by tightening the wing nut. Attach the safety chains.

2. Install the air valve in one of the drain plug threads.

3. Introduce air pressure into the converter housing. Check the pressure with a tire gauge and adjust it to 20 psi.

4. Place the converter in a tank of water. Observe the weld areas for bubbles. If no bubbles are observed, it may be assumed that the welds are not leaking.

ENGINE IDLE SPEED CHECK

Check and, if necessary, adjust the engine idle speed, using the procedure given in Group 8.

If the idle speed is too low, the engine will run roughly. An idle speed that is too high will cause the car to creep when the transmission is shifted into gear and will cause rough transmission engagement.

ANTI-STALL DASHPOT CLEARANCE CHECK

After the engine idle speed has been properly adjusted, check the anti-stall dashpot clearance. Follow the procedure given in Group 8 for checking and adjusting this clearance.

MANUAL LINKAGE CHECKS

Correct manual linkage adjustment is necessary to position the manual valve for proper fluid pressure direction to the different transmission components. Improperly adjusted manual linkage may cause cross-leakage and subsequent transmission failure. Refer to Linkage Adjustments in Part 7-2 or Part 7-3 for detailed manual linkage adjustment procedures.

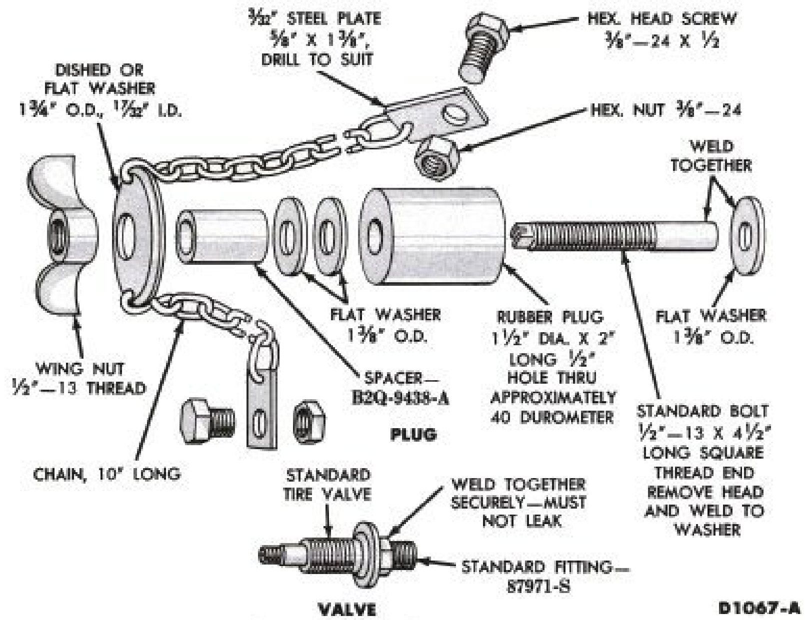


FIG. 3—Converter Leak Checking Tool

CONTROL PRESSURE AND VACUUM DIAPHRAGM UNIT CHECK

When the vacuum diaphragm unit (Fig. 5) is operating properly and the downshift linkage is adjusted properly, all the transmission shifts (automatic and kickdown) should occur within the road speed limits specified in Part 7-4.

If the automatic shifts do not occur within limits or the transmission slips during shift points, the following procedure is suggested to separate engine, transmission, linkage, and diaphragm unit or valve body problems.

1. Attach a tachometer to the engine and a vacuum gauge to the transmission vacuum line at the vacuum unit (Fig 6).

2. Attach a pressure gauge to the control pressure outlet at the transmission.

3. Firmly apply the parking brake and start the engine.

4. Adjust the engine idle speed to the specified rpm. If the engine idle speed cannot be brought within limits by adjustment at the carburetor idle adjustment screw, check the throttle and downshift linkage for a binding condition. If the linkage is satisfactory, check for vacuum leaks in the transmission diaphragm unit (Fig. 7) and its connecting tubes and hoses. Check all other vacuum operated units (such as the power brake) for vacuum leaks.

FIG. 4—Typical Converter Leak Checking Tool Installation

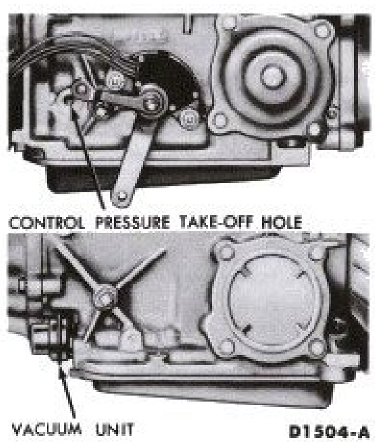


FIG. 5—Typical Diaphragm and Control Pressure Connecting Point

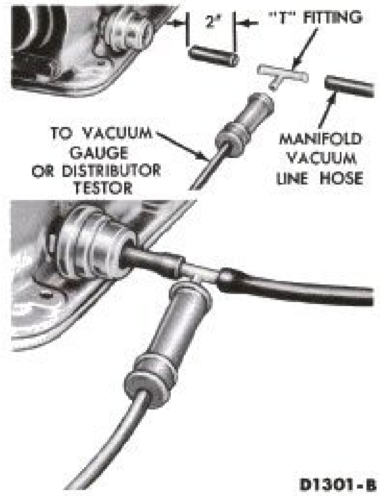


FIG. 6—Typical Vacuum Line Connections

VACUUM UNIT CHECK

To check the vacuum unit for diaphragm leakage, remove the unit from the transmission. Use a distributor tester equipped with a vacuum pump (Fig. 7). Set the regulator knob so that the vacuum gauge reads 18 inches wih the end of the vacuum hose blocked off.

Then, connect the vacuum hose to the transmission vacuum unit. If the gauge still reads 18 inches, the vacuum unit diaphragm **is not leaking.** As the hose is removed from the

FIG. 7—Testing Transmission Vacuum Unit for Leakage

TABLE 1—C4 Automatic Dual Range Transmission
Control Pressure at Zero Output Shaft Speed

Engine Speed or Manifold Vacuum	Throttle Position	Shift Selector Lever Position	*Control (Line) Pressure (psi)
Idle-Above 18 Inches of Vacuum	Closed	P,N,D1,D2,L	55-62
		R	55-96
17.5 to 16.5 Inches of Vacuum	As Required	D1, D2, L, R	Line Pressure Increase
10 Inches of Vacuum	As Required	D1, D2, L	95-110
3 Inches of Vacuum	As Required	D1, D2, L	138-148
		R	213-227

*Transmission Fluid at Normal Operating Temperatures

transmission vacuum unit, hold a finger over the end of the control rod. When the hose is removed, the internal spring of the vacuum unit should push the control rod outward.

TESTING—C4 AUTOMATIC TRANSMISSION

The test results of the following checks should agree with the specifications given in Table 1.

CONTROL PRESSURE CHECK – AT ENGINE IDLE

1. With the transmission in neutral, and at the correct engine idle, the vacuum gauge should show a minimum of 18 inches. If the vacuum reading is lower than 18 inches, an engine problem is indicated or there is leakage in the vacuum line. Make necessary repairs to obtain a minimum vacuum reading of 18 inches.

2. At engine idle, depress and release the accelerator pedal quickly and observe the vacuum gauge. The amount of vacuum should decrease and increase with the changes in throttle openings. If the vacuum response to changes in throttle opening is too low the vacuum line to the diaphragm unit could be restricted. **Make the necessary repairs before completing the test.**

3. At engine idle, check the transmission control pressure gauge at all selector lever positions. Transmission control pressures should agree with the specifications in Table 1.

At different altitudes above sea level, it may not be possible to obtain 18 inches vacuum at engine idle. At these altitudes with idle vacuum of less than 18 inches, refer to the following specifications to determine idle speed control pressure in forward driving ranges D1, D2, D, or L.

Engine Vacuum (At Idle)	Control Pressure (psi)
17 Inches	55-65
16 Inches	55-71
15 Inches	55-77
14 Inches	55-83
13 Inches	55-89
12 Inches	55-95
11 Inches	55-101

CONTROL PRESSURE INCREASE CHECK

The control pressure increase should be checked in all ranges except Park and Neutral. Shift the transmission into D1, D2, L, and R, and check the control pressure increase in each range. With the correct control pressure at engine idle, advance the throttle until the engine vacuum reading falls betewen 17.5-16.5 inches. As the vacuum gauge reading decreases into these specifications, **the control pressure should start to increase.**

Control pressure increase may be noted immediately when the throttle is opened due to the increased pump output, resulting from increase engine rpm. When this happens, the pressure increase point can be checked by using a distributor vacuum tester. Install the distributor tester vacuum line on the diaphragm assembly. Adjust the tester to provide over 18 inches of vacuum. Increase the engine to 750 rpm. Reduce the tester vacuum reading through the 17.5-16.5 inch range and observe the transmission pressure gauge for the pressure increase.

CONTROL PRESSURE CHECK AT 10 INCHES OF VACUUM

A control pressure check should be made at 10 inches of vacuum in D1, D2, and L. Advance the throttle until the engine vacuum reading is 10 inches and note control regulation. Pressure should be 95-110 psi.

CONTROL PRESSURE CHECK AT 3 INCHES OF VACUUM

Check control pressure at 3 inches of vacuum in D1, D2, and L. The control pressure should be 138-148 psi. Then, move the selector lever to R. With the vacuum at 3 inches, the control pressure should be 213-227 psi.

While making this pressure test, do not hold the throttle open for more than five seconds in each detent position. Between each test move the selector lever to neutral and run the engine at 1000 rpm for fifteen seconds to cool the converter.

If the vacuum and pressure gauge readings are within specifications, the diaphragm unit and transmission control pressure regulating system are operating properly.

If transmission control pressure is too low, too high, fails to rise with throttle opening, or is extremely erratic, use the procedure given under the following appropriate headings to resolve the problem.

Control Pressure is Low at Engine Idle. If control pressure at engine idle is low in all selector lever positions, trouble other than the diaphragm unit is indicated.

When control pressure at engine idle is low in all ranges, check for excessive leakage in the front oil pump, case, and control valve body, or a sticking control pressure regulator valve.

Control Pressure is High at Engine Idle. If transmission control pressure at engine idle is too high in all ranges, the trouble may be in the diaphragm unit or its connecting vacuum tubes and hoses, throttle valve, or control rod.

With the engine idling, disconnect

the hose from the diaphragm unit and check the engine manifold vacuum. Hold a thumb over the end of the hose and check for vacuum. If the engine speeds up when the hose is disconnected and slows down as the thumb is held against the end of the hose, the vacuum source is satisfactory.

Stop the engine, and remove the diaphragm unit and the diaphragm unit control rod. Inspect the control rod for a **bent** condition and for corrosion. Check the diaphragm unit for leakage with the distributor tester.

Control Pressure Does Not Increase With Vacuum at 17.5 to 16.5 Inches. When the control pressure is within specifications at engine idle, but does not increase as the vacuum is decreased to the specified limits, first check the control rod between the vacuum unit and throttle valve for proper engagement. If the control rod is not assembled into the end of the throttle valve or vacuum unit, the valve cannot regulate throttle pressure to increase control pressure. Next check for a stuck secondary or primary throttle valve, pressure booster valve, or a stuck control pressure regulator valve.

If control pressure increases before or after vacuum is decreased to 17.5 to 16.5 inches, check for a leaking diaphragm assembly, bent diaphragm can, or worn or bent control rod to the throttle rod.

Control Pressure Not Within Limits at 10 or 3 Inches of Vacuum. If idle pressure and pressure point increase are within specifications but pressures at 10 or 3 inches of vacuum are not within specifications in all ranges, excessive leakage, low pump capacity, or a restricted oil pan screen is indicated.

If pressures are not within specifications for specific selector lever positions only, this indicates excessive leakage in the clutch or servo circuits used in those ranges.

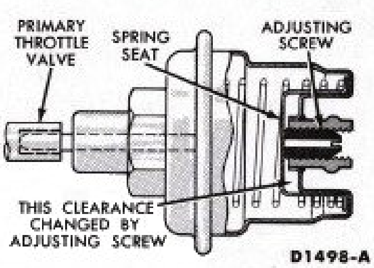


FIG. 8—Vacuum Diaphragm Unit—C4 Automatic Transmission

When the control pressure is within specifications at engine idle, **but not within specifications** at the pressure rise point of 17.5 to 16.5 inches of vacuum, at 10 inches of vacuum, or at 3 inches of vacuum, the vacuum diaphragm unit may need adjustment.

The vacuum diaphragm assembly on the C4 Automatic Dual Range has an adjusting screw in the vacuum hose connecting tube (Fig. 8). The inner end of the screw bears against a plate which in turn bears against the vacuum diaphragm spring. Construction of the assembly is shown in Fig. 8.

All readings slightly high or all readings slightly low may indicate the vacuum unit needs adjustment to correct a particular shift condition.

For example, if the pressure at 10 inches of vacuum was 120 psi and the pressure at 3 inches of vacuum was 170 psi, and upshifts and downshifts were harsh, a diaphragm adjustment to reduce the diaphragm assembly spring force would be required.

If the pressure readings are low, and control pressure does not start to build up until vacuum drops to 15 inches, an adjustment to increase diaphragm spring force is required.

To increase control pressure, turn the adjusting screw in clockwise. To reduce control pressure, back the adjusting screw out by turning counterclockwise. **One complete turn** of the adjusting screw (360°) will change idle line control pressure approximately 2-3 psi. After the adjustment is made, install the vacuum line and recheck the pressures, particularly the pressure at 10 inches of vacuum.

The diaphragm should not be adjusted to provide pressures below the ranges in Table I in order to change shift feel. To do so could result in soft or slipping shift points and damage to the transmission.

STALL TEST

Start the engine to allow it to reach its normal temperature. Apply both the parking and service brakes while making these tests.

The stall test is made in D2, D1, L, or R, at full throttle to check engine performance, converter clutch operation or installation, and the holding ability of the forward clutch, reverse-high clutch and low-reverse band and the gear train one-way clutch. **While making this test, do not hold the throttle open for more than five seconds at a time.** Then move the selector lever to Neutral and run the engine at 1000 rpm for about 15 seconds to cool the converter before making the next test. If the engine speed recorded by the tachometer exceeds the maximum limits specified in Table 2, release the accelerator immediately because clutch or band slippage is indicated.

STALL SPEED TOO HIGH

If stall speed exceeds specifications, band or clutch slippage is indicated, depending on transmission selector lever position. Excessive engine rpm only in D1, D2 and L indicates forward clutch slippage. Excessive engine rpm only in R indicates either reverse-high clutch or low-reverse band slippage. Excessive engine rpm only in D1 indicates gear train one-way clutch slippage.

STALL SPEED TOO LOW

When the stall test speeds are low and the engine is properly tuned, converter stator clutch problems are indicated. A road test must be performed to determine the exact cause of the trouble.

If the stall test speeds are 300 to 400 rpm below the specifications shown in Table 2, and the car cruises properly but has very poor acceleration, the converter stator clutch is slipping.

If the stall test speeds are 300 to 400 rpm below the specified values, and the car drags at cruising speeds and acceleration is poor, the stator clutch could be installed backwards.

Remove the converter and check the stator clutch as described in "Cleaning and Inspection" in Part 7-1.

When the stall test shows normal speeds, the acceleration is good, but the car drags at cruising speeds, the difficulty is due to a seized stator assembly. If the stator is defective, replace the converter.

TABLE 2—Stall Speed Limits

Engine Model	Engine Speed (rpm)
260-V8	1650-1850
289-V-8	1750-1950

INITIAL ENGAGEMENT CHECKS

Initial engagement checks are made to determine if initial band and clutch engagements are smooth.

Run the engine until its normal operating temperature is reached. With the engine at the correct idle speed, shift the selector lever from N to D2, D1, L, and R. Observe the initial band and clutch engagements. Band and clutch engagements should be smooth in all positions. Rough initial engagements in D1, D2, L, or R are caused by high engine idle speed or high control pressures.

SHIFT POINT CHECKS

Check the light throttle upshifts in D1. The transmission should start in first gear, shift to second, and then to third within the shift points specified in Part 7-4.

While the transmission is in third gear, depress the accelerator pedal through the detent (to the floor). The transmission should shift from third to second or third to first, depending on the car speed.

Check the closed throttle downshift from third to first by coasting down from about 30 mph in third gear. The shift should occur within the limits specified in Part 7-4.

When the selector lever is at D2, the transmission can operate only in second and third gears. Shift points for second to third and third to second are the same in both D2 and D1.

With the transmission in third gear and road speed over 30 mph, the transmission should shift to second gear when the selector lever is moved from D2 or D1 to L. When the same manual shift is made below about 25 mph, the transmission will shift from second or third to first. **This check will determine if the governor pressure and shift control valves are functioning properly.**

During the shift check operation, if the transmission does not shift within specifications or certain gear ratios cannot be obtained, refer to the diagnosis guide to resolve the problem.

AIR PRESSURE CHECKS

A "NO DRIVE" condition can exist, even with correct transmission fluid pressure, because of inoperative clutches or bands. The inoperative units can be located through a series of checks by substituting air pressure for the fluid pressure to determine the location of the malfunction.

When the selector lever is at D2, a "NO DRIVE" condition may be caused by an inoperative forward clutch. A "NO DRIVE" condition at D1 may be caused by an inoperative forward clutch or one-way clutch. When there is no drive in L, the difficulty could be caused by improper functioning of the forward clutch or low-reverse band and the one-way clutch. Failure to drive in reverse range could be caused by a malfunction of the reverse-high clutch or low-reverse band. Erratic shifts could be caused by a stuck governor valve.

To make the air pressure checks, drain the transmission fluid, then remove the oil pan and the control valve body assembly. The inoperative units can be located by introducing air pressure into the transmission case passages leading to the clutches, servo, and governor.

FORWARD CLUTCH

Apply air pressure to the transmission case forward clutch passage (Fig. 9). A dull thud can be heard when the clutch piston is applied. If no noise is heard, place the finger tips on the input shell and again apply air pressure to the forward clutch passage. Movement of the piston can be felt as the clutch is applied.

GOVERNOR

Apply air pressure to the control pressure to governor passage and listen for a sharp clicking or whistling noise. The noise indicates secondary governor valve movement.

REVERSE-HIGH CLUTCH

Apply air pressure to the reverse-high clutch passage (Fig. 9). A dull thud indicates that the reverse-high clutch piston has moved to the applied position. If no noise is heard, place the finger tips on the clutch drum and again apply air pressure to detect movement of the piston.

INTERMEDIATE SERVO

Hold the air nozzle in the intermediate servo apply passage (Fig. 9). Operation of the servo is indicated by a tightening of the intermediate band around the drum. Continue to apply air pressure to the intermediate servo apply passage, and introduce air pressure into the intermediate servo release passage.

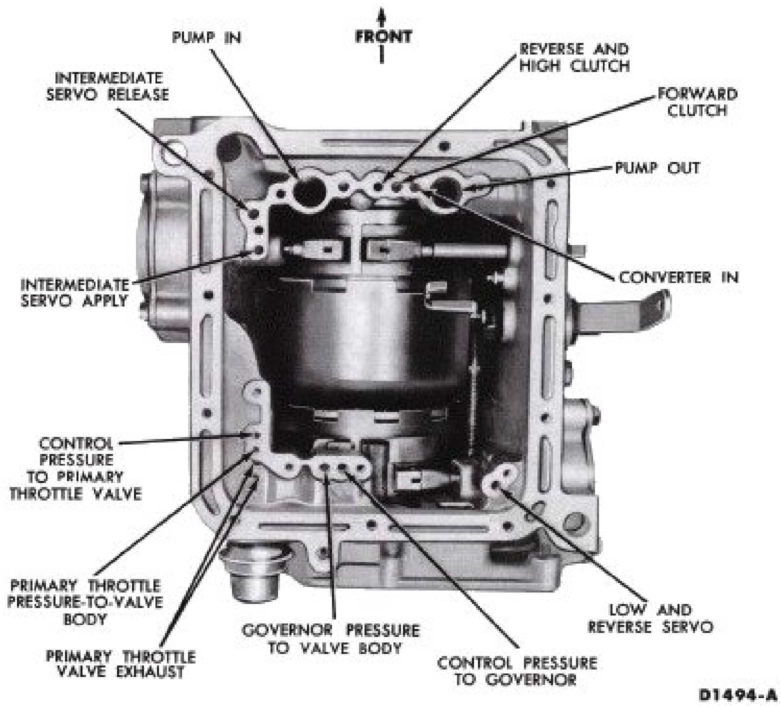


FIG. 9—Case Oil Passage Hole Identification—C4 Automatic Dual Range

The intermediate servo should release the band against the apply pressure.

LOW-REVERSE

Apply air pressure to the low-reverse apply passage (Fig. 9). The low-reverse band should tighten around the drum if the servo is operating properly.

If the servos do not operate, disassemble, clean, and inspect them to locate the source of the trouble.

If air pressure applied to either of the clutch passages fails to operate a clutch or operates both clutches at once, remove and, with air pressure, check the fluid passages in the case and front pump to detect obstructions.

If the passages are clear, remove the clutch assemblies, and clean and inspect the malfunctioning clutch to locate the trouble.

TESTING—FORDOMATIC OR MERCOMATIC SINGLE RANGE TRANSMISSION

The tests results of the following checks should agree with the specifications as outlined in Table 3.

CONTROL PRESSURE CHECK—AT ENGINE IDLE

1. With the transmission and engine at normal operating temperatures, the test gauge readings should agree with the specifications in Table 3.

2. The tachometer and vacuum gauge readings must be correct before the control pressure gauge can record the correct control pressure. If the vacuum is not above 15 inches, first check the vacuum lines; then, if necessary, correct any engine problems that could cause low manifold vacuum.

3. If the transmission control pressure gauge is not recording the control pressure within specifications at engine idle with the manifold vacuum above 15 inches, check the following items:

(a) Front pump output (includes oil level).

(b) Correct operation of the vacuum unit and positioning of the throttle valve to eliminate throttle pressure from acting on the compensator valve.

(c) Balanced position of the control pressure regulator valve.

(d) Balanced position of the compensator valve.

CONTROL PRESSURE INCREASE CHECK

To determine if the transmission hydraulic circuit is regulating control pressure in relationship to the rate of vehicle acceleration, the following test procedure should be used:

1. With the selector lever in D, L, or R, and the engine idling at 450-475 rpm, the manifold vacuum must be above 15 inches and the pressure gauge attached to the transmission should show between 65-70 psi. Take an accurate reading of the pressure gauge with the transmission selector lever in the D position.

2. Slowly increase the engine rpm until the pressure gauge shows an increase in control pressure.

3. When the control pressure starts to increase, the vacuum gauge should show 15-12.5 inches of vacuum. Repeat the complete test with the selector lever in the L and R positions.

The increase in control pressure at 15-12.5 inches of vacuum, depends upon the following conditions:

The internal spring action of the vacuum diaphragm unit must move in relationship to the changes in manifold vacuum to properly position the control rod and throttle valve. The correct amount of control pressure can now enter the throttle pressure circuit. The correct amount of throttle pressure, now acting on the compensator valve, will reduce the amount of compensator pressure acting on the end of the main control pressure regulator valve. This allows the main control pressure regulator valve to move in the opposite direction of the spring to increase control pressure.

If the control pressures were within specifications during the engine idle test, the following valves were free to move and were balanced in the correct position:

(a) Control pressure regulator valve.

(b) Compensator valve.

(c) Vacuum unit had positioned the throttle valve, preventing throttle pressure from entering the circuit that leads to the compensator valve.

During the second test, if the increase in control pressure does not occur between 15-12.5 inches of manifold vacuum, the following items should be checked:

(a) Vacuum diaphragm unit and control rod to throttle valve.

(b) Free movement of the throttle valve.

CONTROL PRESSURE—STALL TEST

Maximum control pressure is necessary to hold or apply the bands or high clutch under full throttle starting or kickdown passing gear operations. The availability of maximum regulated control pressure is tested under a full stall condition (car stopped, brakes applied with the accelerator pedal fully depressed). The stall test can be made with the transmission selector lever in D,

TABLE 3—Fordomatic or Mercomatic Transmission

Control Pressure at Zero Output Shaft Speed

Engine Speed or Manifold Vacuum	Throttle Position	Selector Lever Position	*Control Pressure (psi)
Idle—Above 15 Inches of Vacuum	Closed	All	65-70
15-12.5 Inches of Vacuum	As Required	D, L, R	Pressure Starts Increasing
Stall—Below 1.5 Inches of Vacuum	Wide Open	D, L, R	180-220

*Transmission Fluid at Normal Operating Temperatures

L, and R. Between each stall test, move the selector lever to the N position and increase the engine speed to 1200 rpm for fifteen seconds to recirculate the oil into the converter; this will prevent the transmission from overheating. **Do not stall test for more than 5 seconds at a time.**

During the stall test in the D, L, or R selector positions, the manifold vacuum must be below 1.5 inches; the regulator control pressure should be 180 to 220 psi.

If the control pressures are not within specifications in all selector lever positions for the stall test, the main control regulator valve or compensator valve is not regulating the correct pressure.

STALL TEST

When a transmission stall test is to be made, the following procedure should be observed.

1. Check the engine coolant level and transmission fluid level.

2. If the engine is cold, run it at 1200 rpm with the transmission in N until normal engine temperature is reached.

3. Attach a tachometer to the engine, and position the instrument so that it can be read from the driver's seat.

4. Apply the service and parking brakes firmly.

5. Shift the selector lever to D, L, or R.

6. With a steady pressure, depress the accelerator to the floor. **Hold the pedal at the wide-open throttle position only long enough for the tachometer reading to stabilize. Five seconds is usually adequate time at wide-open throttle to secure an accurate reading.** Between tests, run the engine for at least fifteen seconds at 1200 rpm with the transmission in N to reduce the transmission fluid temperature.

7. If tachometer readings exceed the high limit, as specified in Table 4, or engine run-away is apparent, release the accelerator pedal immediately to prevent further damage to the transmission.

Stall test tachometer readings require careful interpretation. **During a stall test, the engine, the torque converter, and the transmission bands are all under test at the same time.**

STALL TEST—TRANSMISSION BAND CHECK

When the transmission is stall tested in D or L, the low band is applied. When it is stall tested in R, the reverse band is applied. If the engine runs away on a stall test in D or L, but is held within limits in R, the low band is slipping. If the stall test is normal in R, it is probable that the engine, torque converter, and control pressure in the transmission are also normal and that the trouble is confined to the low servo and band. In this case, the band should be checked for proper adjustment, and the stall test repeated in D and L. If the band still slips, attach a pressure gauge and check control pressure before inspecting the servo and band.

If the engine runs away during a stall test in R, but is held within limits in D and L, the reverse band is slipping. Because of the time required to adjust the reverse band, control pressure should be checked before the oil pan is removed.

The transmission high clutch cannot be stall tested since the clutch applies only at road speeds above about 15 mph.

STALL TEST—CONVERTER CHECK

During a normal stall test, the stator one-way clutch locks the stator against counterclockwise rotation (viewed from the front of the car). Should the stator clutch fail to operate properly, the converter will offer much greater resistance to rotation. If this condition is present in the converter, maximum engine speed during a stall test will be about 1200 rpm.

Before changing the converter, the car should be tested on the road. If the stator clutch fails to lock the stator, stall test rpm will be low and acceleration up to about 30 mph will be extremely slow. Above 30 mph acceleration will be nearly normal, and operation at steady speed above 30 mph will be entirely normal.

Remove the converter and check the stator clutch as given in cleaning and inspection procedures.

Should the opposite condition be present in the converter (the stator clutch does not unlock), stall test rpm will be normal but maximum speed obtainable on the road will be about 50 mph.

TABLE 4—Stall Speed Limits

Engine Model	Engine Speed (rpm)
144-IV	1550-1750
170-IV	1700-1900
200-IV	1850-2050
260-2V	1700-1900

DELAYED UPSHIFT POINTS

After a transmission overhaul, the low servo release piston cavity will be completely dry of fluid and filled with air. If a 1-2 shift occurs under this condition, the air in the release cavity is trapped and must be compressed when fluid enters the cavity. This air compression delays the fill time and thereby delays the shift.

To fill the release cavity with fluid and to remove the trapped air, a ball check valve is installed in the apply side and at the top of the low servo piston. Each time pressure enters the apply cavity, a small amount of fluid flows through the check valve before the check ball seats. After about 20 applications (shifts from N to D), the release cavity will be filled. As the fluid flows out through the servo release passage, it takes the trapped air with it. Although the release cavity will stay full of fluid, it will not be under pressure because an exhaust is open at the 1-2 valve in all operations except high gear.

NO DRIVE IN ANY RANGE

In trouble shooting a "NO DRIVE" condition, it must be determined whether the engine is running under load, or is running without load. If the engine is running under load, the transmission is actually locked up, and the converter turbine is at stall. If the engine is running without load, the converter or transmission is actually in neutral.

To determine whether the converter or transmission is causing the "NO-DRIVE" (Neutral) condition, follow this procedure:

1. With the engine stopped, torque the low band adjusting screw to 25 ft-lbs. This puts the transmission in low gear, and by-passes the hydraulic control system as far as first gear engagement is concerned.

2. Apply the parking and service brakes (the transmission is now actually in first gear), and start the engine.

3. Release the brakes and slowly

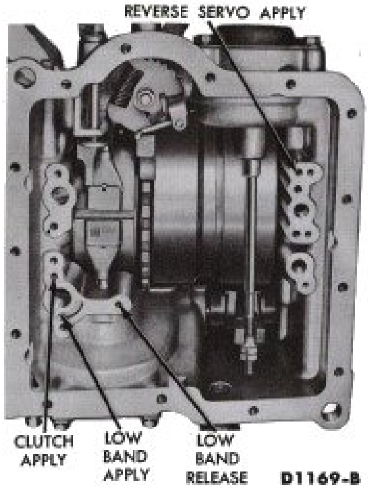


FIG. 10—Clutch and Servo Fluid Passage

advance the throttle. If the car now appears to have a normal drive in first gear, the torque converter is probably satisfactory, and the trouble is in the transmission. **The car should not be driven, even for short distances, under this condition since there may be no fluid flow in the lubrication system.**

4. To find the transmission trouble, refer to the DIAGNOSIS GUIDE.

5. After completing this check, adjust the low band to specifications.

AIR PRESSURE CHECKS

A "NO DRIVE" condition can exist, even with correct transmission fluid pressure, because of inoperative bands or clutch. The inoperative units can be located through a series of checks by substituting air pressure for the fluid pressure to determine the location of the malfunction.

When the selector lever is at D or L, a "NO DRIVE" condition may be caused by an inoperative low band. A "NO DRIVE" condition in R may be caused by an inoperative reverse band. Failure to shift into high may be caused by excessive leakage in the clutch apply and low band release circuit.

Figure 10 shows the case passages which lead to the clutch and servos.

SHIFT POINT CHECK

Shift points and low gear operation should be checked against the speeds specified in Part 7-4.

DIAGNOSIS GUIDE

The Transmission Diagnosis Guide lists the most common trouble symptoms that may be found in the transmission, and gives the items that should be checked to find the cause of the trouble.

The items to check for each trouble symptom are arranged in a logical sequence which should be followed for quickest results. The letter symbols for each item are explained in "Probable Trouble Sources."

If items **A**, **B**, **C**, **D**, **E**, and the stall test have already been checked during the preliminary checks and adjustments, they need not be repeated when following the Diagnosis Guide.

C4 AUTOMATIC DUAL-RANGE TRANSMISSION DIAGNOSIS GUIDE

Trouble Symptoms	Items to Check	
	Transmission in Car	Transmission Out of Car
Rough Initial Engagement in D1 or D2	K B W F E	
Rough Initial Engagement D2 Only	G J	
1-2 or 2-3 Shift Points Incorrect	A B C D W E L	
Rough 2-3 Shift	B F E	
Engine Overspeeds on 2-3 Shift	B G W E F	r
No Shift Points	C D E	
No 2-3 Shift	C D R E	b r
No Forced Downshifts	L W E	
Runaway Engine on Forced Downshift	G F E J B	c
Rough 3-2 or 3-1 Shift at Closed Throttle	K B E	
Shifts 1-3 in D1 and D2	G J	
No Engine Braking In First Gear—Manual Low Range	H I	
Creeps Excessively in D1 or D2	K	
Slips or Chatters in First Gear, D1	A B W F E	a c i
Slips or Chatters in Second Gear	A B G W F E J	a c
Slips or Chatters in R	A H W F E I	b c
No Drive in D1 only	C E	i
No Drive in D2 only	C	
No Drive in R only	C H I E R	b c
No Drive in D1, D2, or L	D W R	a
No Drive in Any Selector Lever Position	A C W F E R	c h
Lockup in D2 only	H I	i
Lockup in R only		a g
Parking Lock Binds or Does Not Hold	C	g
Transmission Overheats	A O F	n

Probable Trouble Sources	
A	Fluid Level
B	Vacuum Diaphragm Unit or Tubes
C	Manual Linkage
D	Governor
E	Valve Body
F	Control Pressure Regulator Valve
G	Intermediate Band
H	Low-Reverse Band
I	Low-Reverse Servo
J	Intermediate Servo
K	Engine Idle Speed
L	Downshift Linkage
M	Converter Drain Plugs
N	Oil Pan Gasket, or Filler Tube
O	Oil Cooler and Connections
P	Manual or Downshift Lever Shaft Seal
Q	1/8-inch Pipe Plug in Side of Case
R	Perform Air-Pressure Check
S	Extension Housing to Case Gaskets and Lockwashers
U	Extension Housing Rear Oil Seal
W	Perform Control Pressure Check
X	Speedometer Driven Gear Adapter Seal
a	Forward Clutch
b	Reverse-High Clutch
c	Leakage in Hydraulic System
d	Front Pump

CONTINUED ON NEXT PAGE

C4 AUTOMATIC DUAL-RANGE TRANSMISSION DIAGNOSIS GUIDE (Continued)

Trouble Symptoms	Items to Check: Transmission in Car	Items to Check: Transmission Out of Car
Maximum Speed Too Low, Poor Acceleration		n
Transmission Noisy in N	F	d
Transmission Noisy in First, Second, and Reverse Gear	F	h d
Transmission Noisy in P	F	d
Fluid Leak	M N O P Q S U X	j m p

	Probable Trouble Symptoms
g	Parking Linkage
h	Planetary Assembly
i	Planetary One-Way Clutch
j	Engine Rear Oil Seal
m	Front Pump Oil Seal
n	Converter One-Way Clutch
p	Front Pump to Case Gasket or Seal
r	Reverse-High Clutch Piston Air Bleed Valve

FORDOMATIC OR MERCOMATIC SINGLE RANGE TRANSMISSION—DIAGNOSIS GUIDE

Trouble Symptoms	Items to Check: Transmission in Car	Items to Check: Transmission Out of Car
Harsh Initial Engagement in D, L and R	D B E	
Slips or Chatters in D or L	A E G H F e K	a e h
Car Will Not Start Moving in D But Will in L	m	m
Slips or Chatters in R	A E C G I F f K	b f n
Creeps Excessively in D	D	
Engine Overspeeds (Buzz-Up) During 1-2 Shift	A L E H F G	g j
Momentary Lockup During 1-2 Shift	A E G H	a j k
Severe 2-1 Shift During Coast-Down	D B G E H	
No 1-2 Shift in D	A L C J Q	a d j p c
Delayed or Severe 1-2 Shift	B J G	d m
Slips Continuously After 1-2 Shift	L A E F G	j g
No 2-1 Forced Downshift (Kickdown)	S G	d
No 2-1 Shift During Coast-Down	G J	
Fluid Forced Out Vent	A M O P N	
Transmission Overheats	A E R N i P M	
Acceleration is Normal—Maximum Speed About 50 mph	i	i
Acceleration Very Poor—Operation Above 30 mph at Steady Throttle Normal	i	i
Engine does not start by pushing car	A C G H m	c d a e m
Parking lock does not hold, or binds	C	l o

	Probable Trouble Symptoms
A	Fluid Level
B	Vacuum Diaphragm or Line Leaking, Throttle Linkage
C	Manual Linkage
D	Engine Idle Speed
E	Control Pressure Check
F	Air Pressure Check
G	Control Valve Body
H	Low Band Adjustment
I	Reverse Band Adjustment
J	Governor
K	Engine—Transmission Mounts
L	Fluid Odor—Check for Burned Clutch Plates
M	Transmission External Vent
N	Cooler Flow Check
O	Fluid Aeration Check
P	Fluid Check for Engine Coolant Contamination
Q	High Clutch Piston
R	Converter Cooling Air Passages
S	Downshift Linkage
a	Low Servo and Band
b	Reverse Servo and Band
c	Rear Pump
d	Leakage in Control Pressure Main Circuit
e	Leakage in Low Servo Apply Circuit
f	Leakage in Reverse Servo Apply Circuit
g	Leakage in Clutch Apply or Low Servo Release Circuit
h	Planetary Gears
i	Converter One-Way Clutch
j	High Clutch
k	Low Servo Piston Return Spring
l	Parking Linkage
m	Low Servo Piston Check Valve
n	Cracked or Broken Rear Band Anchor
o	Front Band Installed Backwards—Strut out of Position
p	High Clutch Piston

2 COMMON ADJUSTMENTS AND REPAIRS

TRANSMISSION FLUID DRAIN AND REFILL

Normal maintenance and lubrication requirements do not necessitate periodic automatic transmission fluid changes.

If a major failure, such as a clutch, band, bearing, etc., has occurred in the transmission, it will have to be removed for service. At this time the converter must be thoroughly flushed to remove any dirt.

When filling a dry transmission and converter, install five quarts of fluid. Start the engine, shift the selector lever as in Step 7 below, and check and add fluid as necessary.

Following is the procedure for partial drain and refill due to front band adjustment or minor repair.

1. On a Fordomatic transmission, disconnect the fluid filler tube from the transmission oil pan.

2. Loosen and remove all but two of the oil pan bolts and drop one edge of the oil pan to drain the oil. Remove and thoroughly clean the oil pan and screen. Discard the oil pan gasket.

3. Place a new gasket on the oil pan and install the screen and pan on the transmission.

4. On a Fordomatic transmission, connect the filler tube to the oil pan and tighten the fitting securely.

5. Add three quarts of fluid to the transmission through the filler tube.

6. Run the engine at idle speed for about two minutes. Check the oil level and add oil if necessary. Run the engine at fast idle speed (about 1200 rpm) until it reaches its normal operating temperature. **Do not race the engine.**

7. Shift the selector lever through all the positions, place it at P, and check the fluid level. If necessary, add enough fluid to the transmission to raise the level to the F (Full) mark on the dipstick. **Do not overfill the transmission.**

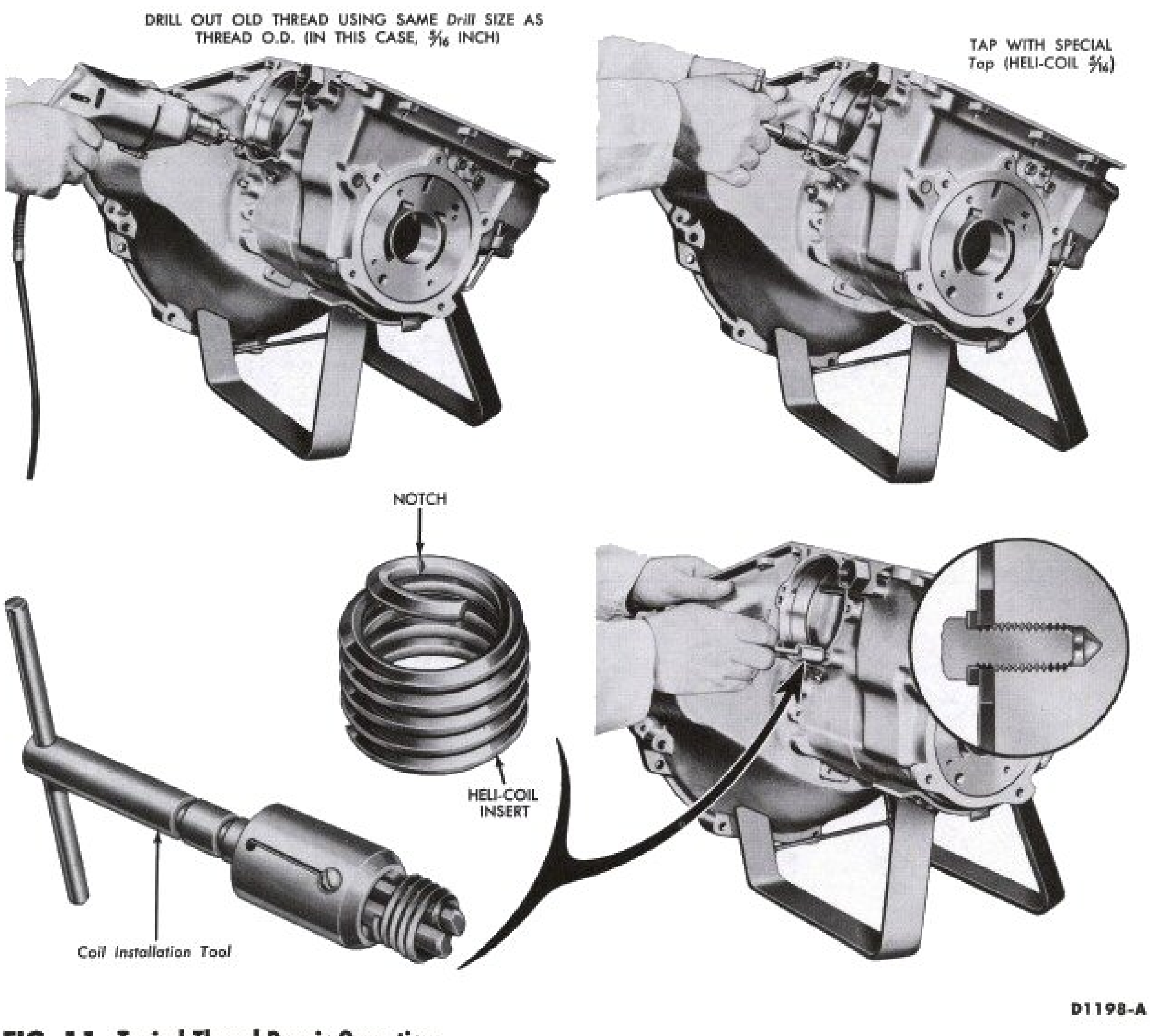


FIG. 11—Typical Thread Repair Operation

OIL COOLER FLUSHING PROCEDURE

When a clutch or band failure or other internal trouble has occurred in a transmission that had the water oil cooling feature, any metal particles or clutch plate or band material that may have been carried into the cooler should be removed from the system by flushing the cooler before the transmission is put back into service.

1. Disconnect the fluid return line from the rear of the transmission.

2. Start the engine and drain about two quarts of fluid from the cooler into a pan. Discard the drained fluid. If there is no fluid flow or the fluid does not flow freely from the return line, shut off the engine and disconnect both lines at the cooler and transmission.

3. Use an air hose (with not more than 100 psi air pressure) to reverse flush the lines and the cooler.

4. Connect both lines at the cooler and the pressure line at the transmission.

5. Start the engine and check the fluid flow. If the fluid flows freely, connect the return line at the transmission and fill the transmission with new fluid to the specified level. If there is no fluid flow or if the flow is restricted, replace the radiator. **Do not attempt to correct cooler or cooling line leaks by closing off the lines.**

OIL COOLER TUBE REPLACEMENT

When fluid leakage is found at the oil cooler, the entire radiator must be replaced. **The oil cooler cannot be removed from the radiator for replacement.**

When one or more of the oil cooler steel tubes must be replaced, each replacement tube must be fabricated from the same size steel tubing as the original line.

Using the oil tube as a guide, bend the new tube as required, add the necessary fittings, and install the tube.

After the fittings have been tightened, add fluid as needed, and check for fluid leaks.

THREAD REPAIR

Figure 11 shows the procedure developed by the Heli-Coil Corporation of Danbury, Connecticut for repairing damaged threads.

Thread service kits may be purchased from local jobbers or the Heli-Coil Corporation. To repair a damaged thread, the following procedures should be carefully followed.

1. Drill out the damaged threads, **using the same drill size as the thread O.D.** For example, use a 5⁄16-inch drill for a 5⁄16-18 thread.

2. Select the proper **special** tap and tap the drilled hole. The tap is marked for the size of the thread being repaired. Thus, the special tap marked 5⁄16-18 will not cut the same thread as a standard 5⁄16-18 tap. It does cut a thread large enough to accommodate the insert, and after the insert is installed the original thread size (5⁄16-18) is restored.

3. Select the proper coil inserting tool. These tools are marked with the thread size being repaired. Place the insert on the tool (Fig. 11) and adjust the sleeve to the length of the insert being used.

Press the insert against the face of the tapped hole. Turn the tool clockwise and wind the insert into the hole until the insert is ½ turn below the face.

4. Working through the insert, bend the insert tang straight up and down until it breaks off at the notch (Fig. 11).

5. If the inserts are not properly installed, they can be removed with the extractor tool. Place the extractor tool in the insert so that the blade rests against the top coil ¼ to ½ turn away from the end of the coil. Tap the tool sharply with a hammer so that the blade cuts into the insert. Exert downward pressure on the tool and turn it counterclockwise until the insert is removed.

3 CLEANING AND INSPECTION

Clean all parts with suitable solvent and use moist free air to dry off all parts and clean out the various oil passages.

The composition clutch plates and bands should not be cleaned in a vapor degreaser or with any type of detergent solution. To clean these parts, wipe them off with a lint-free cloth.

CONVERTER CLEANING

If there is reason to believe that the converter has an excessive amount of foreign material in it, a commercial converter cleaning machine or the following cleaning procedure should be used:

1. With the converter on the bench, remove both drain plugs and tilt the converter in all directions to drain as much fluid as possible.

2. Install the drain plugs and fill the converter through the pump drive hub with a light-body oil such as kerosene, or a cleaning solvent suitable for transmission cleaning.

3. Install the tool shown in Fig. 12 in the converter. Expand the bushing in the turbine spline. Rotate the tool to circulate the fluid in the converter.

4. Remove both drain plugs and thoroughly drain the converter.

5. Repeat the procedure given in steps 2, 3, and 4, as required, to remove excessive foreign material.

6. Install the drain plugs.

The torque converter is permanently enclosed in a welded steel housing and cannot be disassembled for servicing.

A special tool (Fig. 13) must be used to check the condition of the converter. This special tool is used to check the turbine and stator end play and the operation of the one-way stator clutch.

TURBINE AND STATOR END PLAY CHECK

1. Insert the tool into the converter pump drive hub until it bottoms.

2. Install the guide over the converter pump drive hub.

3. Expand the split fiber bushing in the turbine spline by tightening the adjusting nut. Tighten the adjusting nut until the tool is securely locked to the turbine spline.

4. Attach a dial indicator to the tool (Fig. 13). Position the indicator button on a converter pump drive hub, and set the dial face at 0 (zero).

5. Lift the tool upward as far as it will go and note the indicator reading. The indicator reading is the total end play which the turbine and stator share. If the total end play exceeds specifications, replace the converter.

FIG. 12—Converter Checking Tool

6. Loosen the adjusting nut to free the split bushing, and then remove the tool from the converter.

STATOR ONE-WAY CLUTCH CHECK

1. Install the stator outer race holding tool in one of the holes provided in the stator.

2. Insert the tool in the converter pump drive hub.

3. As the tool enters the converter, the spline on the tool (Fig. 13) will engage the stator clutch inner race spline.

4. Place a torque wrench on the tool (Fig. 13). The tool (and stator inner race) should turn freely clockwise (from the pump drive hub side of the converter). It should lock up and hold a 10 ft-lb pull when the wrench is turned counterclockwise. Try the clutch for lockup and hold in at least five different locations around the converter. If the clutch fails to lockup and hold a 10 ft-lb torque, replace the converter unit. The metal ring part of the tool has to be held by hand to position the locking tool during this check.

5. Remove the tools from the converter.

STATOR TO IMPELLER INTERFERENCE CHECK

1. Position a stator support shaft on the bench with the spline end of the stator shaft pointing up (Fig. 14).

2. Place the front pump rotor over the stator shaft with the flat side of the rotor down.

3. Place the converter over the stator support shaft so that the front pump driving lugs are in normal (running) engagement with the pump rotor. The converter pump driving hub will bottom on the rotor.

4. While holding the stator shaft stationary, try to rotate the converter counterclockwise. The converter should rotate freely without any signs of interference or scraping within the converter assembly.

5. If there is an indication of scraping, the trailing edges of the stator blades may be interfering with the leading edges of the impeller blades. In such cases, replace the converter.

STATOR TO TURBINE INTERFERENCE CHECK

1. Position the converter, front side down, on the bench.

2. Install the front pump assembly (complete) to engage the mating splines of the stator support and stator and pump drive gear lugs.

3. Install the input shaft, engaging the splines with the turbine hub (Fig. 15).

4. While holding the pump stationary, attempt to rotate the turbine with the input shaft. The turbine should rotate freely in both directions without any signs of interference or scraping noise.

5. If interference exists, the stator front thrust washer may be worn, allowing the stator to hit the turbine. In such cases, the converter must be replaced.

FRONT PUMP AND STATOR SUPPORT

1. Inspect the clutch drum journal for wear and roughness.

2. Check the side clearances between the clutch apply pressure seal rings and their grooves in the stator support. These clearances should be between 0.0035 and 0.0045 inch.

3. Remove the clutch apply rings and install them in their normal running position in the clutch drum. Then check the ring gaps. Manufacturing tolerance on this ring gap is 0.002-0.009 inch.

4. Inspect the input shaft bushing in the stator support shaft for wear.

Check the oil ring grooves in the stator support for nicks, burrs or damaged edges. Check the gasket mating surface of the pump body for damaged surface.

5. On a Fordomatic transmission, the converter pressure relief valve and converter-out check valve may be removed from the pump housing for inspection.

6. Inspect the converter pump drive hub bushing in the front pump housing. Inspect the pump seal in the pump housing.

REAR PUMP FORDOMATIC-MERCOMATIC TRANSMISSION ONLY

1. Inspect the output shaft support bronze bushing in the rear pump housing for wear. Inspect the rear area of the housing ID for governor pressure seal ring wear.

2. Install the governor pressure seal rings in the pump housing and check the ring gap. Manufacturing tolerance for this ring gap is 0.001-0.006 inch.

3. Check the governor pressure orifice for obstruction.

4. Inspect the slippers and pump housing for wear. The slippers may be replaced as a set in the old housing and rotor.

GOVERNOR

1. Inspect the governor valve(s) and housing for wear. **Crocus cloth may be used to polish the valve if care is taken to avoid rounding the sharp edges of the valve.**

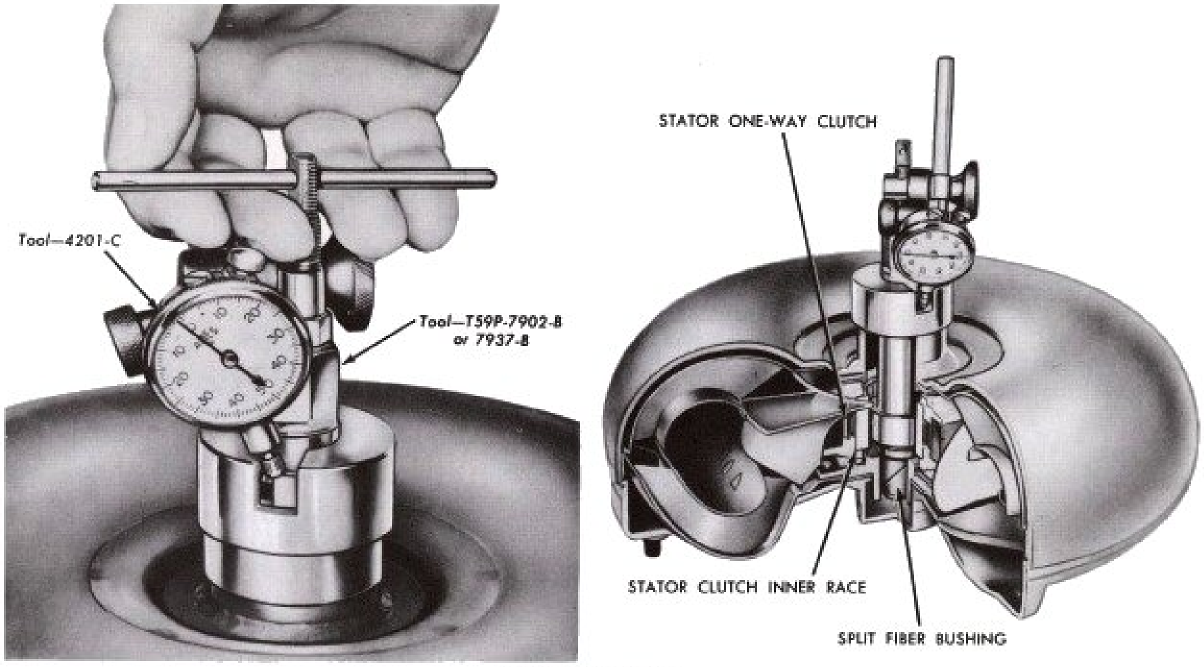
2. Install the governor valve in valve body and check the valve for free movement. The valve should fall of its own weight when dry.

CLUTCH ASSEMBLY

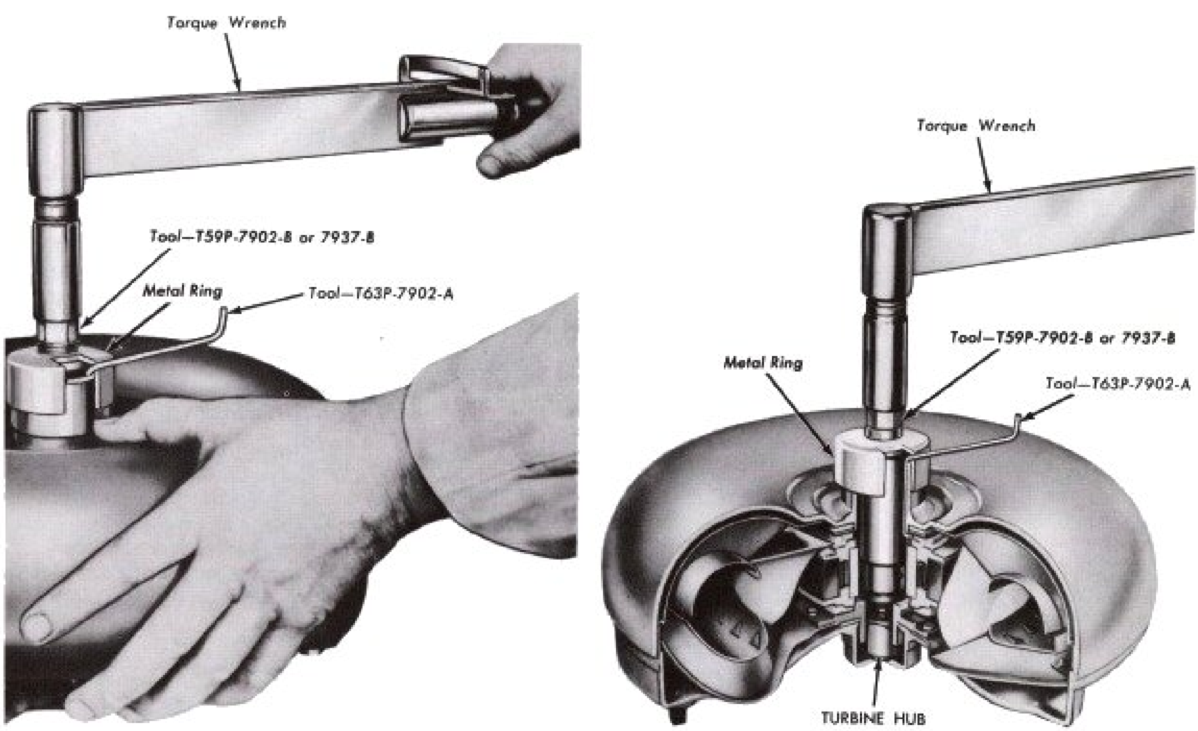
1. Inspect the composition clutch plates for damage. These plates should be flat. If the plates are not flat, they must be replaced. If the old plates are to be re-used, they must **not** be cleaned in a vapor degreaser or cleaned with any type of detergent solution. Wipe them clean with lint-free towels.

If new composition plates are to be installed, soak them in automatic transmission fluid for at least 15 minutes before assembling them in the clutch drum. This soaking prevents damage to the plates during the transmission fluid fill period and initial "running-in".

2. Inspect the steel clutch plates. These clutch plates should also be



END PLAY CHECK



STATOR CLUTCH CHECK

D1516-A

FIG. 13—Typical Converter Checking Tool Installation

FIG. 14—Stator to Impeller Interference Check—Typical

flat. If they are not flat, they should be replaced.

3. Inspect the clutch piston ball check valve for free movement and proper seating. Make sure the orifice in the clutch piston is open.

4. Inspect the clutch arm bushing for wear.

CONTROL VALVE BODY

1. Inspect all valve and plug bores for scores. Check all fluid passages for obstruction. Inspect the check valves for free movement. Inspect all mating surfaces for burrs or distortion. Inspect all plugs and valves for burrs and scores. **Crocus cloth can be used to polish valves and plugs if care is taken to avoid rounding the sharp edges of the valves and plugs.**

2. Inspect all springs for distortion. Check all valves and plugs for free movement in their respective bores. Valves and plugs, when dry, must fall from their own weight in their respective bores.

PINION CARRIER (FORDOMATIC-MERCOMATIC)

1. Inspect the pilot journal on the primary sun gear shaft and the pilot bushing in the output shaft.

2. Inspect the primary sun gear rear thrust washer. Inspect the primary sun gear front thrust bearing and bearing race.

3. Inspect the converter-out pressure seal ring groove, which is machined in the primary sun gear shaft at the clutch hub spline. Excessive leakage at this ring will permit converter-out fluid to by-pass the cooling system and return to sump through the clutch and planetary gears.

4. Inspect the needle bearing thrust washers. Inspect the needle bearings for wear and roughness.

5. Inspect the planet carrier for excessive wear at the thrust washer locations.

6. Inspect the pinion shafts for wear, roughness, and for burred locking notches.

7. Inspect all gear teeth for burrs, cracks, and nicks.

8. Inspect the pinion carrier teeth that are engaged by the parking pawl.

9. Inspect the governor pressure seal ring grooves in the output shaft.

10. Inspect the rubber seal at the front of the output shaft spline for wear or damage.

PINION CARRIERS C4 AUTOMATIC TRANSMISSION

The front planet carrier parts are serviceable. Individual parts of the reverse planet carrier are not serviceable.

1. Inspect the front planet thrust bearing and races for excessive wear or damaged needle bearings.

2. Inspect the pinion needle bearing thrust washers for scored condition.

3. Inspect the pinion gears for damaged or excessively worn areas.

4. Inspect the carrier for loose pinion gear shaft pin fit. Inspect the pins for excessive wear.

5. Check for free rotation of the pinion gears in their assembled position.

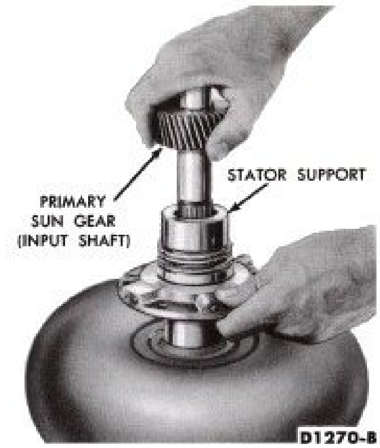


FIG. 15—Stator to Turbine Interference Check—Typical

SERVO-ASSEMBLIES

1. Inspect the servo piston seals for defects that would cause hydraulic leakage.

2. Inspect the cover seal and sealing surface for defects.

3. On pistons that have check valves, inspect the servo piston check valve for proper seating in the piston.

CASE

1. Inspect the case for cracks.

2. With an air hose, check all fluid passages for obstruction or cross leakage.

3. Check all case linkage parts for free travel and proper engagement.

4. Check the vent for obstructions with an air hose.

ONE-WAY CLUTCH (C4 AUTOMATIC)

1. Inspect the outer and inner races for scores or damaged surface area where the rollers contact the races.

2. Inspect the rollers and springs for excessive wear or damage.

3. Inspect the spring and roller cage for bent or damaged spring retainers.

PART 7-2 C4 AUTOMATIC DUAL RANGE TRANSMISSION

1 DESCRIPTION AND OPERATION

IDENTIFICATION

Figure 1 identifies the type of C4 Automatic Dual Range three-speed transmission used. The identification tag (Fig. 2) attached by the low-reverse servo cover bolt, includes the model prefix and suffix, as well as a service identification number and date code. The service identification number indicates changes to service details which affect interchangeability **when the transmission model is not changed.** For interpretation of this number, see the Master Parts Catalog.

Table 1 shows the engine and transmission model applications.

TABLE 1—Engine and Transmission Application

Engine Model	Transmission Model
260-2V	PCW-Y
289-4V	PCW-Z

TORQUE CONVERTER

The hydraulic torque converter (Fig. 3) consists of an impeller (pump), a turbine, and a stator. All these parts are enclosed and operate in a fluid-filled housing.

When the engine is running, the fluid in the torque converter flows from the impeller to the turbine and back to the impeller through the stator. This flow produces a maximum torque increase of about 2 to 1 when the turbine is stalled. When enough torque is developed by the impeller, the turbine begins to rotate, turning the turbine shaft (input shaft).

The converter torque multiplication gradually tapers off as turbine speed approaches impeller speed, and it becomes 1 to 1 when the turbine is being driven at 9/10 impeller speed. This is known as the "coupling point."

When the turbine is rotating at

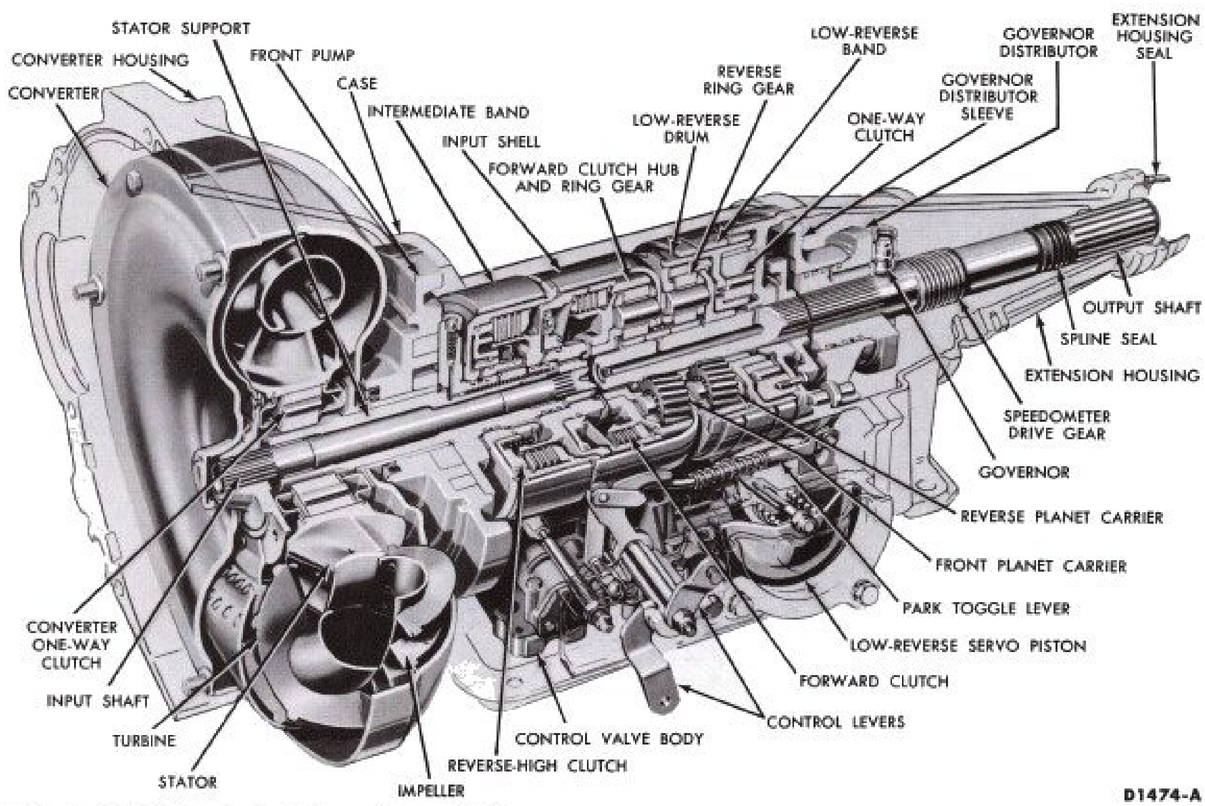


FIG. 1—C4 Automatic Dual Range Transmission

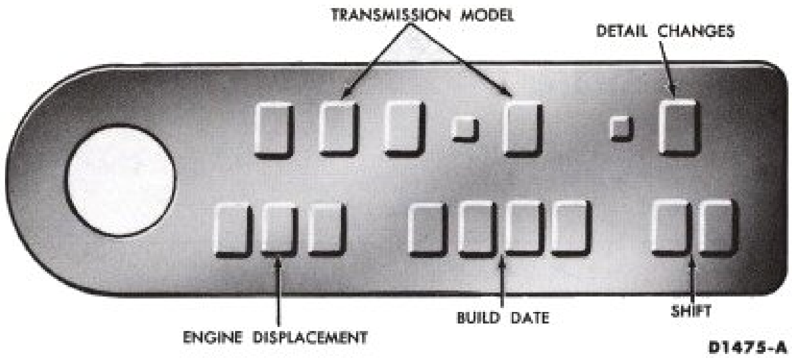


FIG. 2—Identification Tag

less than 9/10 impeller speed, the converter is multiplying torque. The fluid leaving the turbine blades strikes the front face of the stator blades. These blades are held stationary by the action of a one-way clutch (Fig. 3) as long as the fluid is directed against the front face of the blades.

When the turbine rotates faster than 9/10 impeller speed the converter no longer multiplies torque. The fluid is directed against the back face of the stator blades. As the one-way clutch permits the stator to rotate only in the direction of impeller rotation, the stator begins to turn with the impeller and turbine. The converter operates as an efficient fluid coupling as long as the turbine speed remains greater than 9/10 impeller speed.

A constant flow of fluid into and out of the converter is maintained. The fluid coming out of the converter is forced through a cooler located in the radiator tank.

PLANETARY GEAR TRAIN, CLUTCHES, BANDS, AND SERVOS

PLANETARY GEAR TRAIN

The gear train consists of an in-

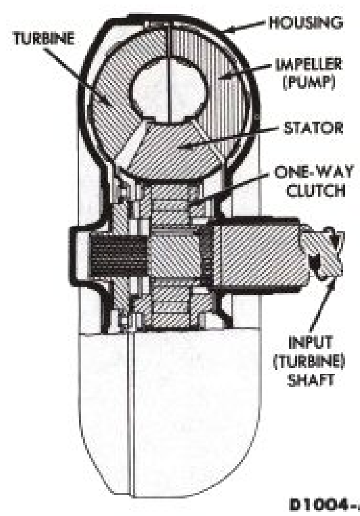


FIG. 3—Cross Section of Typical Torque Converter

put shaft that is splined to the turbine of the converter and the forward clutch cylinder (Fig. 4). The forward clutch cylinder rotates the steel internal clutch plates of the forward clutch and the composition clutch plates of the reverse-high clutch. When the reverse-high clutch

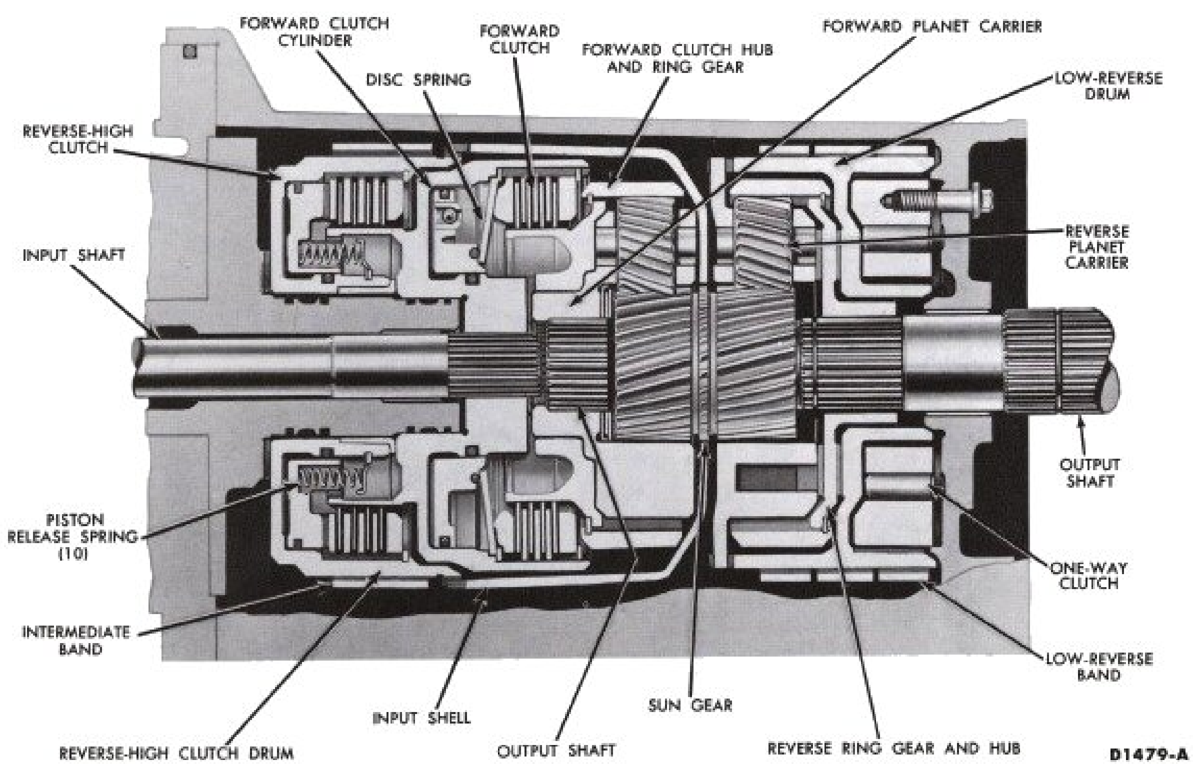


FIG. 4—Gear Train, Clutches and Bands

is applied, the external area of the clutch hub is splined to and drives the input shell to rotate the sun gear. When the forward clutch is applied, the composition clutch plates drive the forward clutch hub and ring gear. The ring gear rotates the forward planet gears.

When applied, the intermediate band holds the reverse-high clutch drum, input shell and sun gear from rotating.

The sun gear, which is driven by the input shell, is meshed with the forward and reverse planet gears. The reverse planet carrier and low reverse drum are locked together with external splines. The low-reverse drum can be held from rotating by the low-reverse band. In D1 the low-reverse drum is also held from rotating by a roller type one-way clutch.

The forward planet carrier, reverse ring gear hub, park gear and governor distributor are all splined to the output shaft.

FORWARD CLUTCH

The input shaft is splined to and drives the forward clutch cylinder (Fig. 4). Rotation of the cylinder drives the steel clutch plates in the forward clutch and the composition clutch plates of the reverse-high clutch.

When the forward clutch piston is applied by hydraulic pressure, the movement of the piston against the disc spring locks the steel and composition clutch plates together to drive the forward clutch hub and ring gear.

When hydraulic pressure is released from the piston, the disc spring moves the piston to the released position. As the disc spring moves, the steel and composition clutch plates are released. This stops the rotation of the forward clutch hub and ring gear (Fig. 4). The forward clutch is applied in all forward drive gear ratios.

REVERSE-HIGH CLUTCH

When hydraulic pressure is directed to the clutch piston, the piston moves against the release springs (Fig. 4). The piston movement locks the steel and rotating composition clutch plates together. The steel clutch plates drive the reverse-high clutch drum which is splined to the input shell. Rotation of the input shell drives the sun gear which is splined to the input shell.

To release the reverse-high clutch, hydraulic pressure is exhausted from the apply side of the piston. The return springs move the piston to the released position. The steel and composition clutch plates are now released to stop rotation of the reverse-high clutch drum, input shell and sun gear.

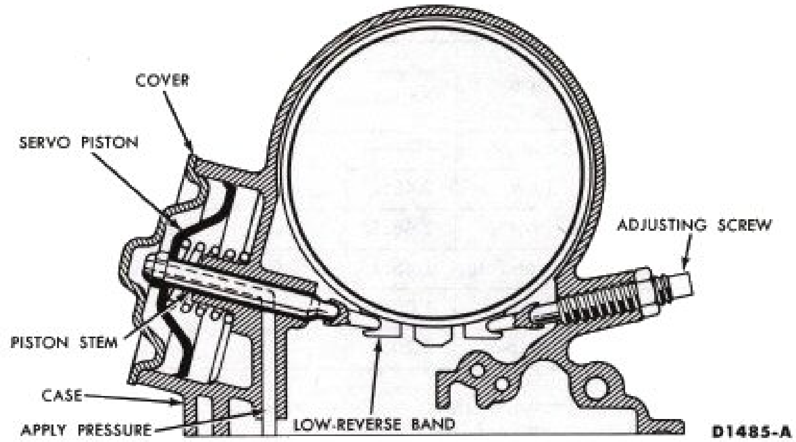


FIG. 6—Low-Reverse Servo and Band

INTERMEDIATE SERVO AND BAND

The intermediate servo is machined into the transmission case and the band has an **external** adjustment screw (Fig. 5). To apply the servo, hydraulic pressure is directed from the control valve body, through a hole in the case to the hole in the servo piston stem. The pressure passes through the center of the piston stem and then to the apply side of the piston. The piston moves against the return spring to tighten the intermediate band around the reverse-high clutch drum.

To release the servo piston, hydraulic pressure is directed to the release side of the piston. The release pressure is assisted by the compressed return spring to move the servo piston and intermediate band to the OFF position. The intermediate servo and band are applied only during the intermediate gear operation.

LOW-REVERSE SERVO AND BAND

The low-reverse servo is machined into the transmission case and the band has an **external** adjustment screw (Fig. 6). To apply the servo, hydraulic pressure is directed from the control valve body through a hole in the case to a hole in the

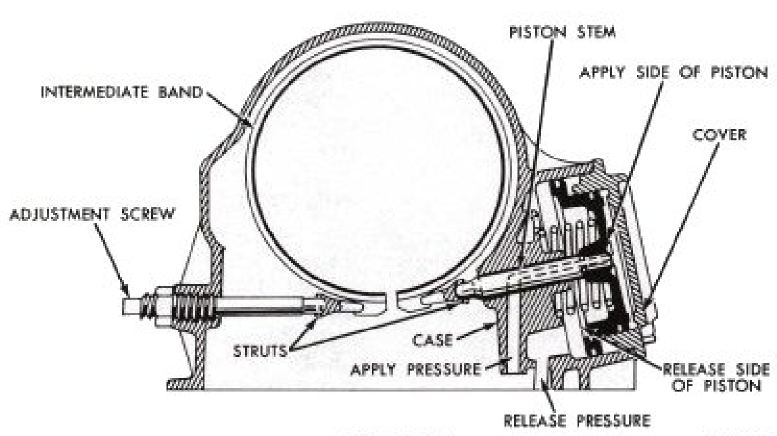


FIG. 5—Intermediate Servo and Band

TABLE 2–Gear Ratios

Transmission Selector Position	Gear	Gear Ratios	Forward Clutch	Reverse High Clutch	Intermediate Band	Low Reverse Band	One-Way Clutch
N or P	Neutral	———	Off	Off	Off	Off	Off
L	Low	2.46:1	On	Off	Off	On	Holding
D1	Low	2.46:1	On	Off	Off	Off	Holding
D1 or D2	Intermediate	1.46:1	On	Off	On	Off	Over-Running
D1 or D2	High	1.00:1	On	On	Off	Off	Over-Running
R	Reverse	2.20:1	Off	On	Off	On	Not Affected

piston stem. The pressure then passes through the center of the piston stem to the apply area of the servo piston. The apply pressure force moves the piston against the piston return spring to tighten the low-reverse band around the low-reverse drum.

To release the servo piston and band, the hydraulic pressure is exhausted from the apply side of the piston. The compressed return spring expands to release the piston and the low-reverse band.

POWER FLOW

All Gear Rotations are viewed from the front of transmission. Table 2 shows the gear ratios obtained in the different selector lever positions.

POWER FLOW NEUTRAL

In neutral (Fig. 7) the clutches or bands are not applied, therefore, no power is transmitted to the output shaft.

POWER FLOW FIRST GEAR

In low gear (Fig. 7), the forward clutch is applied, and the planet one-way clutch or low-reverse band is holding the low-reverse drum and reverse planet carrier from rotating. The power flow is through the input shaft and into the forward clutch. The input shaft is splined to and drives the forward clutch cylinder. Rotation of the forward clutch drives the forward clutch hub and ring gear. The ring gear rotates the forward planet gears clockwise to cause the sun gear to rotate counterclockwise.

Counterclockwise rotation of the sun gear turns the reverse planet gear clockwise. The reverse planet carrier being splined to the low-reverse drum is held from rotating by the one-way clutch or low-reverse band.

With the reverse planet carrier held stationary, the clockwise rotation of the reverse planet gears rotates at the same speed as the output clockwise. The hub of the reverse ring gear is splined to the output shaft and rotates the output shaft clockwise.

The output shaft rotation is at a reduced speed, compared to the input shaft rotation, but at an increased torque.

The output shaft rotation at a reduced speed is caused by the fact that the forward planet carrier rotates at the same speed of the output shaft and in the same direction since the carrier is splined to the output shaft. The forward ring gear and planet assembly are rotating in the same direction, but the planet carrier is rotating at a slower speed than the ring gear. Therefore, the low gear ratio (torque multiplication) is a combination of the ratios provided by the forward and reverse planet assemblies.

POWER FLOW INTERMEDIATE GEAR

In intermediate gear (Fig. 7), the forward clutch is applied and the intermediate band is holding the reverse high clutch drum, input shell and sun gear from turning.

The power flow is through the input shaft into the forward clutch and forward front planet assembly ring gear. The sun gear is held from rotating by the intermediate band. This causes the forward planet pinions to rotate (walk) around the sun gear, carrying the forward planet carrier with them. The foward planet carrier, being splined to the output shaft, causes clockwise rotation of the output shaft at a reduction in speed compared to the speed of the input shaft, and at an increase in torque.

Clockwise rotation of the output shaft causes clockwise rotation of the output shaft ring gear, causing the reverse planet pinions to also rotate (walk) around the sun gear in a clockwise direction. The reverse planet carrier will also rotate clockwise and the one-way clutch inner race, being splined to the reverse planet carrier, will overrun.

POWER FLOW HIGH GEAR

In high gear (Fig. 7), the forward and reverse-high clutches are applied. The power flow is through the input shaft into the forward clutch cylinder. (The forward clutch cylinder rotates the steel clutch plates of the forward clutch and the composition clutch plates of the reverse-high clutch.) The forward clutch directs the power flow through the forward clutch hub and ring gear to the forward planet carrier.

The reverse-high clutch directs the power flow through the input shell to the sun gear. With the sun gear and the forward clutch hub ring gear driven at the same speed the forward planet assembly (that is splined to the output shaft) is forced to rotate the output shaft at the same speed and direction to provide high gear.

POWER FLOW REVERSE

In reverse (Fig. 7), the reverse-high clutch and low-reverse band are applied. The power flow is through the input shaft, reverse-high clutch, input shell and to the sun gear. Clockwise rotation of the sun gear causes counterclockwise rotation of the reverse planet gears.

The low-reverse band, holding the low-reverse drum and reverse planet carrier from turning, causes the re-

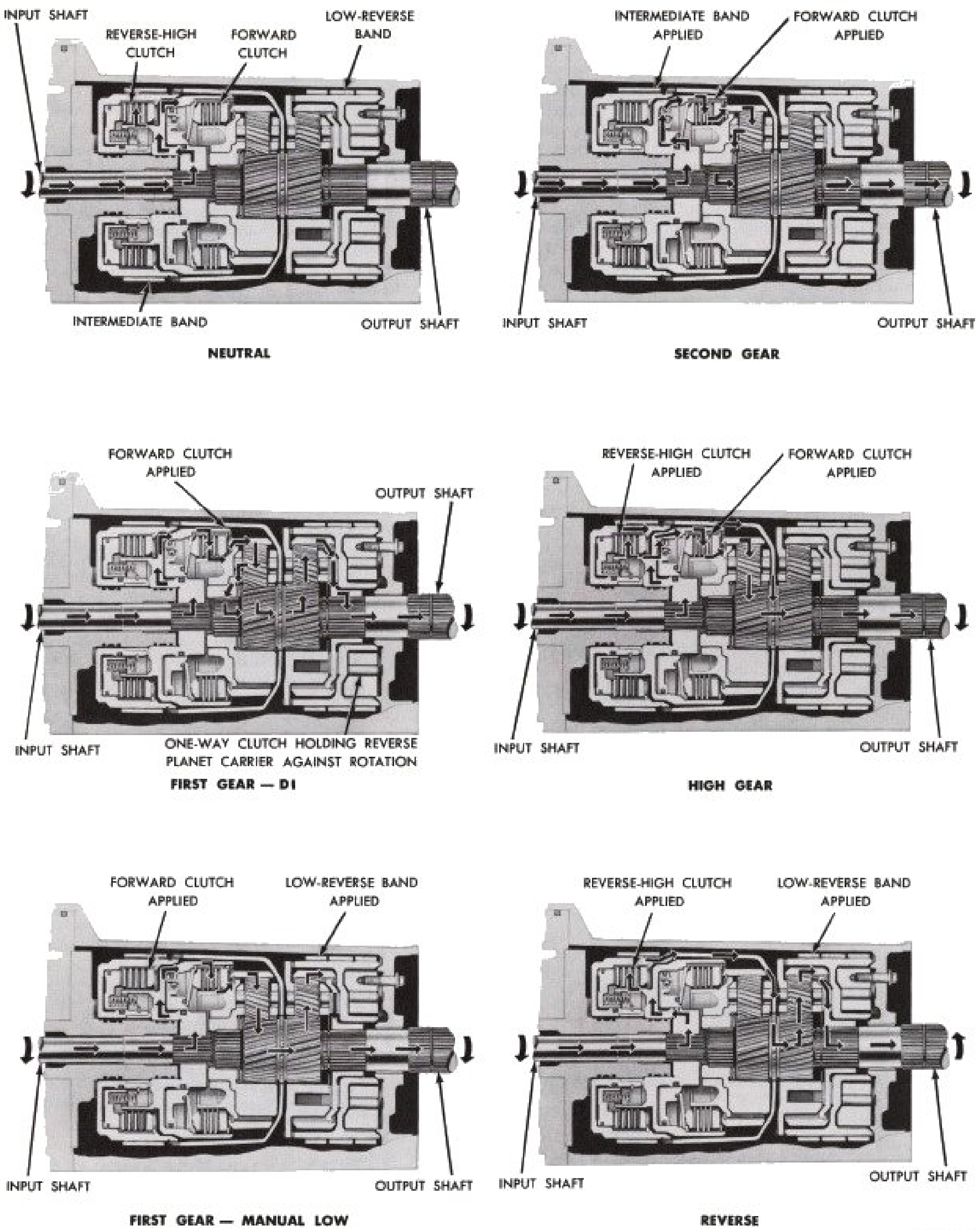


FIG. 7—Power Flow

verse planet gears to rotate counterclockwise.

This rotates the reverse ring gear and hub counterclockwise. The hub splined to the output shaft rotates the output shaft counterclockwise at a reduction in speed and at an increase in torque for reverse gear.

HYDRAULIC CONTROL SYSTEM OPERATION

FRONT PUMP

The transmission has only one pump located at the front of the transmission case. The converter hub rotates the pump drive gear to produce hydraulic pressure to the main control valve body and to the primary throttle valve located in the transmission case (Fig. 8).

CONTROL PRESSURE REGULATOR VALVE

The control pressure regulator valve assembly consists of the control pressure regulator valve, spring, retainer, pressure booster valve, and sleeve, located in one bore in the control valve body (Fig. 8). Front pump oil pressure is directed to the three valleys of the valve. The difference in diameter between the end land and the second land provides an area differential for regulation of control pressure. Fluid pressure in this area can move the valve against the spring force. The spring force is calibrated so that the regulator valve will move, at approximately 60 psi front pump pressure, allowing the third land of the valve to open the converter supply port. This permits additional pump volume to be used to pressurize the converter. If pressure supplied by the front pump is greater than that required to maintain 60 psi control pressure, including converter and lube requirements, the regulator valve will move further, allowing the fourth land to open the port which allows excess pump volume to be discharged into the sump (Fig. 8).

Control pressures over 60 psi, which are required under various operating conditions, are obtained by delivering throttle pressure to the pressure booster valve, causing the valve to move against the regulator valve, assisting the spring force. In reverse control pressure is directed to the pressure booster valve to increase control pressure.

To reduce control pressures above 60 psi when higher pressures are not required, pressure is delivered to the end of the control regulator valve opposite the spring end, opposing the spring force.

The control pressure regulator valve can be balanced into any required position to regulate the necessary changes in control pressure due to the various driving conditions.

EMERGENCY RELIEF VALVE

The ball-type check valve is located in the front pump pressure circuit (Fig. 8). If, for any reason, regulated front pump pressure exceeds 275 psi, the spring loaded check valve opens to exhaust the excessive control pressure.

MANUAL VALVE

Two control pressure circuits direct regulated front pump pressure to the manual valve. In the Neutral and Park position, the manual valve is positioned to restrict control pressure from going to the shift control valves and clutches or servos. When the transmission selector lever is moved to the Drive, Low or Reverse positions, the manual valve is positioned to direct control pressure to the shift control valves and necessary clutches or servos.

PRIMARY THROTTLE VALVE

Thottle pressure regulation is controlled by the changes in manifold vacuum acting on the transmission vacuum unit. As the amount of vacuum increases or decreases, the diaphragm spring either compresses or expands. The spring action moves the control rod and positions the throttle valve to regulate throttle pressure.

When the manifold vacuum is below 20 inches, primary throttle pressure is directed to the secondary throttle valve and the 2-3 back-out valve (Fig. 8).

SECONDARY THROTTLE VALVE

Primary throttle pressure is regulated when engine vacuum is below 20 inches. Throttle pressure is normally used to provide shift delays and to control pressures. Shift delay or further control of pressure is not required within range of 20-17.5 inches of vacuum. Therefore, the **secondary throttle valve** provides secondary throttle pressure, which will start at 17.5-16.5 inches of vacuum and increase as engine vacuum decreases. The secondary throttle valve is a spring-loaded, balanced type valve with throttle pressure acting on both ends of the valve (Fig. 8).

Primary throttle pressure is delivered to the end of the secondary throttle valve opposite the spring. When primary throttle pressure is increased to the point where the force on the end of the valve is greater than spring force, the valve will move and allow primary throttle pressure to enter the secondary throttle pressure circuit. This valve movement closes the exhaust port which is open when the valve is held closed by the spring. Throttle pressure is delivered to the spring end of the valve where it will assist the spring in overcoming the primary throttle pressure force on the other end of the valve.

When the force on the spring end of the valve, caused by secondary throttle pressure, plus the spring force exceeds the primary throttle valve pressure force, the valve will move, opening the exhaust port and closing the feed port. In this manner secondary throttle pressure is regulated and depends upon the amount of primary throttle pressure, but during regulation, the secondary throttle pressure will be at a value below primary throttle pressure. In addition, because of the difference in areas of the two ends of the valve (the spring end being smaller), secondary throttle pressure will increase at a slightly higher rate than primary throttle pressure. Figure 9 shows the relationship between primary throttle pressure and secondary throttle pressure.

Secondary throttle pressure is delivered to the end of the pressure booster valve where it will cause the valve to move against the control pressure regulator valve, assisting the valve spring. This will result in higher control pressure being required to balance the control pressure regulator valve and increase the regulated control pressure.

Secondary throttle pressure is also delivered to the throttle booster valve, to the throttle modulator valve at the end of the 2-3 shift valve train, where it is modulated, and then to the 1-2 shift valve.

THROTTLE BOOSTER VALVE

Carburetor throttle plate openings above 50° provide slight changes in

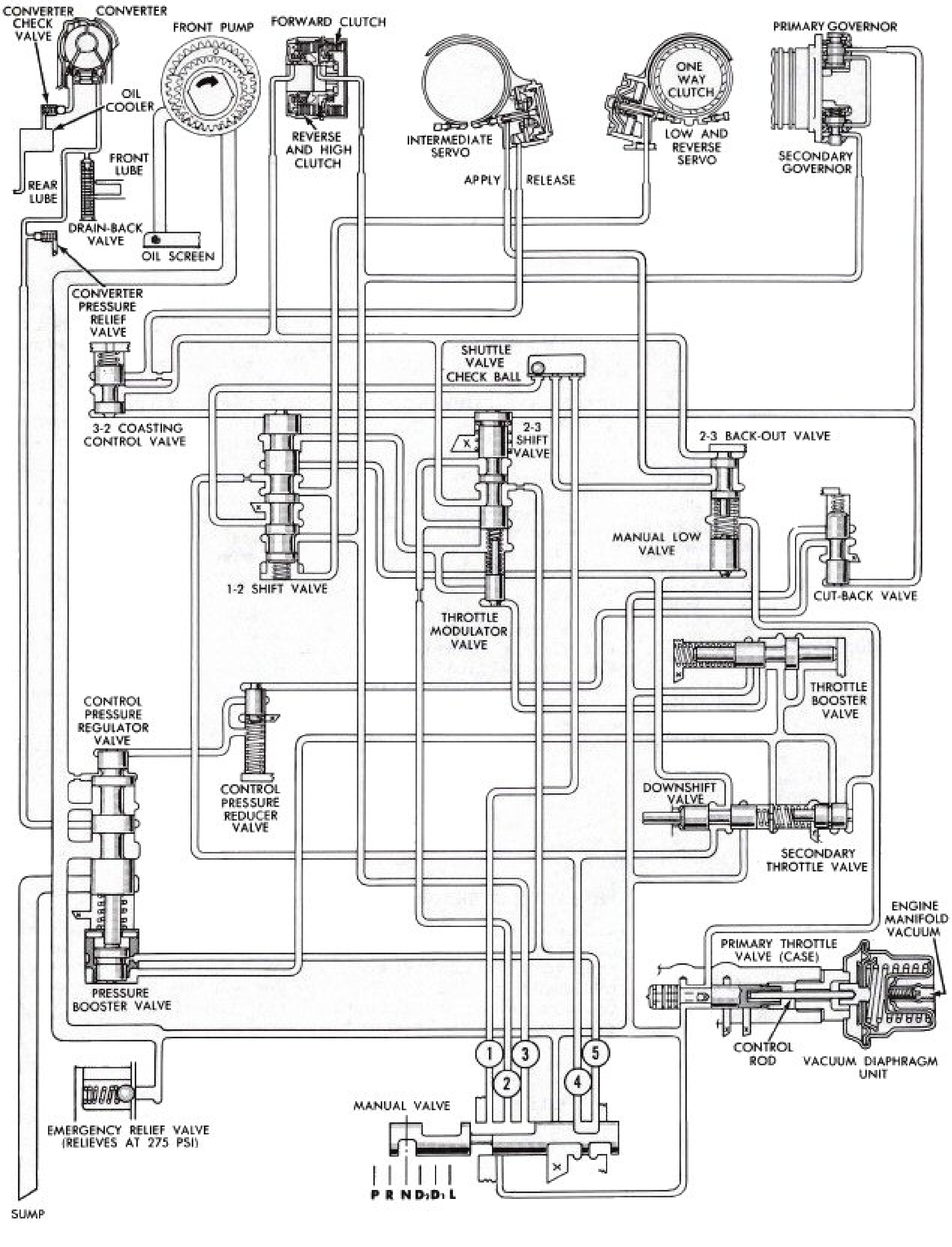


FIG. 8—Hydraulic Control System—Neutral Circuit

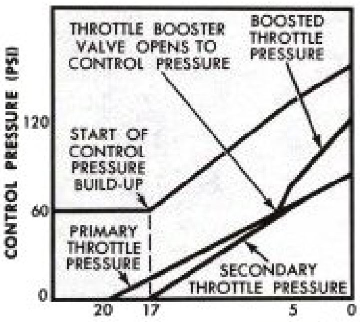


FIG. 9—Throttle Pressure Regulation

manifold vacuum or increased primary throttle pressure regulation by the transmission vacuum unit. To control the shift points, at throttle plate openings above 50°, throttle pressure positions the throttle booster valve to boost (increase) throttle pressure going only to the shift valves (Fig. 8). Figure 9 shows the rate of increase in boosted throttle pressure compared to the primary and secondary throttle pressure regulation.

THROTTLE MODULATOR VALVE

The throttle modulator valve, located in the end of the 2-3 shift valve bore, reduces throttle pressure which acts on the end of the 2-3 shift valve and in the valley of the 1-2 shift valve. Modulated throttle pressure in these areas provides the necessary shift delay action (Fig. 8).

Throttle pressure moves the valve against the spring force to open the throttle pressure circuit to the shift valves. Throttle pressure is now directed to the spring side of the valve. The spring force added to the throttle pressure moves the valve back to the closed position. From the spring side of the valve, this opens the exhaust circuit through the downshift valve to the manual valve (manual valve in D1 or D2 position). This reduces the throttle pressure on the spring side of the valve until throttle pressure (opposite side from spring) again moves the valve to open the circuit to the shift valves.

This type of valve action modulates (reduces) the throttle pressure acting on the 2-3 shift and 1-2 shift valves to control automatic shift points.

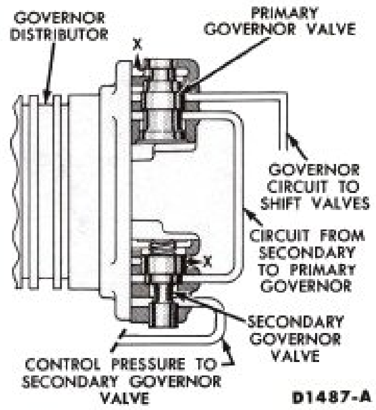


FIG. 10—Governor Circuit

SECONDARY GOVERNOR VALVE

In the forward driving ranges, control pressure from the forward clutch circuit is directed to the secondary governor valve (Fig. 10). Due to the differential in areas of the lands of the valve, the pressure will move the valve and open the exhaust port. However, the valve is spring loaded and as a result the valve is returned by the spring force. This results in a regulated pressure flow from the secondary valve to the primary valve even when the vehicle is standing still. As the car starts to move and the governor assembly rotates, the centrifugal force of the valve will be added to the spring force to close off the exhaust port and the regulated secondary governor pressure will increase in the circuit going to the primary governor valve.

PRIMARY GOVERNOR VALVE

Governor pressure delivered from the secondary governor valve to the primary governor valve will tend to hold the primary governor valve closed, preventing governor pressure going into the governor circuit to the shift valve (Fig. 10). When the output shaft starts to turn, centrifugal force on the primary governor valve will tend to move the valve in the direction that will allow the governor pressure to pass through the valve and into the circuit to the shift valves. At approximately 10 mph, the centrifugal force of the valve will overcome the governor pressure force allowing the valve to snap open and allow governor pressure through the valve into the governor circuit to the shift valves. The design is such that below 10 mph no governor pressure is present in the circuit to the shift valves. At 10 mph, the governor pressure regulated by the secondary governor valve is approximately 12 psi, and when the primary valve moves, the governor pressure will pass through the valve unaffected. The secondary governor valve now regulates the amount of governor pressure going through the primary valve and in the circuit to the shift valves.

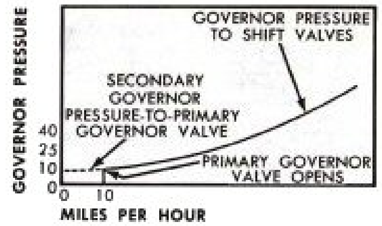


FIG. 11—Governor Pressure Regulation

Governor pressure is directed to the cut-back valve, end of the 2-3 shift valve, 1-2 shift valve and the 3-2 coasting control valve. Figure 11 shows the relationship between governor pressure and output shaft rpm. Note that governor pressure regulated by the secondary governor valve is not delivered to the shift valves until the car speed reaches approximately 10 mph, at which time the primary governor valve opens the governor circuit.

CUT-BACK VALVE

Increased control pressure is required to prevent clutch and band slippage under certain driving conditions. Once the vehicle is moving, conditions requiring high control pressure are considerably reduced. As soon as governor pressure is delivered through the primary governor valve (approximately 10 mph) the cut-back valve is forced to move by governor pressure. This closes the exhaust port and allows control pressure to pass through the cut-back valve, past the control pressure reducer valve (if line pressure is above 41 psi and to the end of the control pressure regulator valve, opposite the regulator valve spring (Fig. 8).

CONTROL PRESSURE REDUCER VALVE

The valve is a regulating valve, which reduces control pressure being

directed to the end of the control pressure regulator valve by 41 psi. For example, if the control pressure being directed to the control pressure reducer valve is 75 psi, the pressure going to the end of the control pressure regulating valve will be 34 psi.

The reduced control pressure on the end of the control pressure regulator valve opposes regulator valve spring force and will reduce control pressure to provide pressures required for certain operating conditions. Figure 12 shows the relationship between control pressure and car speed at selected constant vacuum values. Note that cut-back in control pressure occurs at 10 mph. This is caused by the function of the cut-back and control pressure reducer valves, directing control pressure to the end of the control pressure regulator valve (Fig. 8).

1-2 SHIFT VALVE

The 1-2 shift valve is held closed by spring force assisted by modulated throttle pressure (Fig. 8). Governor pressure opens the 1-2 shift valve, when the force on the valve created by governor pressure exceeds the spring force and the modulated throttle pressure force. The valve will move downward, closing the exhaust port and allowing control pressure to pass through the valley of the valve to accomplish the 1-2 shift.

If governor pressure is reduced to the point where spring force exceeds governor pressure force, the 1-2 shift valve will move up (close) cutting off the flow through the valve and opening the exhaust port allowing a downshift to low gear.

When the 1-2 shift valve opens, the modulated throttle pressure feed port is closed. This prevents torque demand (throttle pressure) 2-1 downshifts. With the 1-2 shift valve

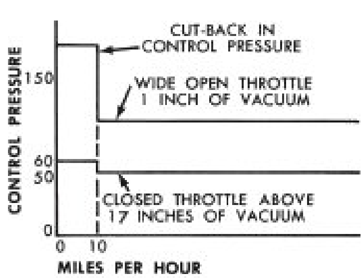


FIG. 12—Control Pressure Regulation

open (down), the differential in area between the upper two lands is exposed to the low and reverse gear fluid passages. This passage will direct control pressure to this area of the 1-2 shift valve from the downshift valve when the accelerator pedal is moved through (kickdown) detent to provide a forced 2-1 downshift.

In manual low, control pressure is delivered to the spring end of the 1-2 shift valve, preventing opening of the 1-2 shift valve. If the transmission is in intermediate or high gear, the downshift to low gear is accomplished by the control pressure which passes through the downshift valve from the manual valve in the same manner as the forced downshift in D1 range.

All downshifts to first gear are controlled by car speed, governor pressure regulation acting on the end of the 1-2 shift valve.

In D2 range, movement of the 1-2 shift valve will have no effect on transmission operation since the front band is applied by control pressure that passes through the shuttle check valve ball cavity (Fig. 8), seating the ball on the hole of the separator plate in the circuit from the 1-2 shift valve.

SHUTTLE VALVE CHECK BALL

The check ball is located in a cavity of the valve body and contacts two holes in the separator plate. The check ball is used to open or close two circuits. In D1 the circuit from the 1-2 shift valve moves the check ball to block the exhaust circuit to the manual valve and allow pressure to be directed through the 2-3 back-out valve to the apply side of the intermediate servo piston (Fig. 8).

In D2 the control pressure positions the check ball to prevent control pressure going to the exhaust circuit back through the lower valley of the 1-2 shift valve. The valve body cavity is constructed so the check ball cannot seat or block off the circuit to the 2-3 back out valve and then to apply the intermediate servo piston.

2-3 SHIFT VALVE

In D1 and D2, the valve is used to control the apply of the reverse-high clutch, and the release of the intermediate servo during the intermediate to high gear shift operation (Fig. 8). In R the valve directs control pressure to apply the reverse-high clutch for reverse gear.

The 2-3 shift valve is held closed by the 2-3 shift valve spring, throttle modulator valve spring and the modulated throttle pressure force. In D1 the control pressure force acting on the differential in area of the lands of the valve also holds the valve closed.

Governor pressure is used to open the 2-3 shift valve. When the governor pressure exceeds the forces holding the valve closed, the valve will move downward (open), closing the exhaust passage through the manual valve and opening the passage to allow control pressure to apply the reverse-high clutch and release the intermediate servo (Fig. 8).

With the 2-3 shift valve opened (down), the throttle modulator valve is held down, blocking off modulated throttle pressure going to the 2-3 shift valve and 1-2 shift valve. The circuit which delivered D1 control pressure to the differential in area of the 2-3 shift valve lands is also closed.

The 2-3 shift valve can be returned to the closed (up) position, causing a downshift under one or more of the following conditions:

Governor Pressure Reduced. If governor pressure is reduced to the point where it can no longer hold the shift valve down against spring force and secondary throttle pressure force, the valve will move up causing a downshift. Under closed throttle conditions, the 2-3 shift valve will close at approximately 10 mph (speed at which governor primary valve cuts off governor pressure). Since governor pressure is cut off at this road speed, the 1-2 shift valve also closes at the same time. This will provide a 3-1 downshift when coasting in D1 range.

Secondary Throttle Pressure Increased. If secondary throttle pressure is increased sufficiently, it will move the throttle modulator valve and consequently move the 2-3 shift valve up, causing a 3-2 torque demand downshift.

Control Pressure Introduced Below 2-3 Shift Valve. If the downshift valve is moved through detent, control pressure is directed to the underside of the 2-3 shift valve, forcing the valve up and causing a forced 3-2 downshift. Maximum 3-2

forced downshift speed is controlled by governor pressure.

Exhausting D1 Pressure to the 2-3 Shift Valve. During high gear, if the manual valve is moved to the L range, the circuit that feeds pressure to the 2-3 shift valve will be opened to exhaust, allowing the high-reverse clutch apply and intermediate servo release pressure to be directed to exhaust through the manual valve, causing a 3-2 downshift.

2-3 BACK-OUT VALVE

The purpose of the 2-3 back-out valve is to provide smooth upshifts to high gear when the accelerator pedal is suddenly released while accelerating in second gear. Under normal throttle acceleration, when the 2-3 shift valve moves to cause a 2-3 upshift, the control pressure passes through the 2-3 shift valve, to apply the reverse-high clutch and release the intermediate servo. This same pressure is also directed to the end of the 2-3 back-out valve. With the throttle open, primary throttle pressure on the opposite end of the 2-3 back-out valve, assists spring force in holding the valve up, so that there will be no valve movement until after the 2-3 shift has been completed (Fig. 8).

When the car is being accelerated and the throttle is closed before completion of a 2-3 upshift, there may be enough pressure in the reverse-high clutch cylinder to prevent the clutch from slipping at the reduced engine torque input, but not enough pressure to release the intermediate servo. This condition could cause a harsh 2-3 shift. When the throttle is closed during a 2-3 shift, the primary throttle pressure will be reduced to zero at the 2-3 back-out valve and the reverse-high clutch apply pressure, on the end of the 2-3 backout valve, will move the valve down against the spring force. This action immediately connects the reverse-high clutch apply circuit to the intermediate servo apply circuit. **This reduces the pressure on the apply side of the servo to the same value as in the reverse-high clutch, and also on the release side of the intermediate servo.** When this happens the intermediate band is released to provide a smooth 2-3 shift.

MANUAL LOW VALVE

When a shift to manual low range is made or a forced downshift is made from high gear, the function of the manual low valve makes sure that the 2-3 back-out valve will be moved up the instant that pressure drops in the reverse-high clutch apply and intermediate servo release circuit. This is accomplished by directing control pressure to the end of the manual low valve when the L range is selected or when the downshift valve is moved to the downshift position (Fig. 8).

3-2 COASTING CONTROL VALVE

During a coasting (closed throttle) downshift, governor pressure is reduced with road speed. When governor pressure drops to zero (at 10 mph), the spring of the 3-2 coasting control valve moves the valve down (Fig. 8). The intermediate servo release pressure now has to pass through the orifice to time the apply of the intermediate servo for a smooth 3-2 downshift.

DOWNSHIFT VALVE

The downshift valve travel is controlled by the accelerator pedal position and the throttle linkage. The downshift linkage rod does not cause the downshift valve to move until the driver positions the accelerator pedal for the forced downshift operation. With the accelerator pedal fully depressed, the downshift valve is positioned against the spring to open the circuit to the manual low valve, 2-3 shift valve, and 1-2 shift valve.

Depending upon the road speed of the car, the governor pressure force acting on the shift valves can be overcome by the control pressure from the downshift valve to obtain forced downshift operations.

HYDRAULIC CONTROL SYSTEM OPERATION

NEUTRAL AND PARK

The position of the manual valve stops the regulated control pressure from being directed to the shift control valves or the clutches and servos (Fig. 8). The front pump output hydraulic pressure is regulated by the control pressure regulator valve to maintain 55-62 psi in the circuits going to the manual valve, primary throttle valve, downshift valve, throttle boost valve and cut-back valve (Fig. 8).

With both clutches and bands released, no torque will be transmitted through the clutches to the output shaft.

INTERMEDIATE GEAR – D2

When the driver moves the transmission selector lever to D2, the manual linkage rod moves the transmission manual lever and manual valve to the D2 position. This opens circuits 1, 2, and 3 to the shift control valves (Fig. 8).

Circuit 1 directs control pressure through the 2-3 back-out valve to apply the intermediate servo. Circuit 2 directs control pressure to the upper valley and lower land of the 2-3 shift valve. Circuit 3 directs control pressure to the 1-2 shift valve lower valley, and then applies the forward clutch piston and directs control pressure to the secondary governor valve (Fig. 8). With the forward clutch and intermediate servo applied, the transmission power flow is for the intermediate gear operation.

HIGH GEAR – D2

In intermediate gear, as the road speed increases the governor pressure acting on the end of the 2-3 shift valve is increased. When the governor pressure moves the 2-3 shift valve against spring and modulated throttle pressure, the control pressure that was blocked off at the lower land of the 2-3 shift valve can now pass through the lower valley of the valve (Fig. 8). The control pressure is directed from the lower valley of the 2-3 shift valve to apply the reverse-high clutch and release the intermediate servo. With the reverse-high clutch and forward clutch applied, the transmission power flow is for high gear operation.

LOW GEAR – D1

When the selector lever is moved to the D1 position, control pressure circuits 2 and 3, from the manual valve, are opened to the shift valves (Fig. 8). Circuit 2 directs control pressure to the upper valley and lower land of the 2-3 shift valve. Circuit 3 directs the control pressure to the lower valley of the 1-2 shift valve, then to apply the forward clutch and to the secondary governor valve.

In D1 with only the forward clutch applied, the one-way clutch holds the low-reverse drum and reverse

planet carrier from rotation to obtain the low gear power flow operation.

INTERMEDIATE GEAR – D1

Due to the increased road speed, the governor pressure moves the 1-2 shift valve to open the lower valley of the valve to control pressure. From the lower valley of the 1-2 shift valve, the control pressure is directed to the shuttle valve check ball. The check ball is moved to block off the circuit that will exhaust at the manual valve (circuit No. 1).

The control pressure from the 1-2 shift valve is directed to the 2-3 back-out valve. The pressure passes through the valley of the 2-3 back-out valve to apply the intermediate servo and band.

With the intermediate band and forward clutch applied, the transmission flow is for intermediate gear operation.

HIGH GEAR – D1

To obtain high gear, the increased governor pressure moves the 2-3 shift valve to open the lower valley of the valve to control pressure. From the lower valley of the 2-3 shift valve, the control pressure applies the reverse-high clutch and releases the intermediate servo (Fig. 8). With the reverse-high clutch and forward clutch applied, the power flow is for the high gear operation.

MANUAL LOW – L

When the manual valve is in the L detent position, circuits 3 and 4 direct control pressure to the shift valves (Fig. 8). Circuit 3 directs control pressure to the 1-2 shift valve, then to apply the forward clutch, and also to the secondary governor valve. Circuit 4 directs control pressure through the center valley of the 1-2 shift valve to apply the low reverse servo and band. From the same circuit control pressure is directed to the end of the 1-2 shift valve, to lock the valve in position.

With the forward clutch and low reverse band applied, the power flow is for low gear. To eliminate shift points in manual low, circuit 4 directs control pressure through the downshift valve to the 2-3 and 1-2 shift valves. The control pressure acting at the end of the 2-3 shift valve and in the upper valley of the 1-2 shift valve, locks these valves in position against governor pressure. If the 1-2 shift valve was moved by governor pressure, the transmission would shift from low to intermediate gear during the manual low gear operation.

REVERSE GEAR – R

When the manual valve is moved to R, circuits 4 and 5 direct control pressure to the shift valves (Fig. 8). Circuit 4 directs control pressure through the center valley of the 1-2 shift valve to apply the low-reverse servo and band. Circuit 5 directs control pressure through the lower valley of the 2-3 shift valve to apply the reverse-high clutch. The circuit also directs control pressure to the pressure booster valve to assist the control pressure regulator valve spring to obtain higher control pressure regulation in reverse.

With the reverse-high clutch and low-reverse band applied, the power flow is for the reverse gear operation. With the forward clutch circuit 3 not pressurized, no control pressure is directed to the governor valves. Therefore, there is no governor pressure acting on the shift valves in reverse.

2 IN-CAR ADJUSTMENTS AND REPAIRS

CONTROL LINKAGE ADJUSTMENTS

The transmission control linkage adjustments should be performed in the order in which they appear in this section of the manual.

THROTTLE AND DOWNSHIFT LINKAGE ADJUSTMENT

1. Apply the parking brake, and place the selector lever at N.
2. Run the engine at normal idle speed. If the engine is cold, run the engine at fast idle speed (about 1200 rpm) until it reaches normal operating temperature. When the engine is warm, slow it down to normal idle speed.
3. Connect a tachometer to the engine.
4. Adjust engine idle speed to the specified rpm with the transmission selector lever at D1 or D2, the drive positions.
5. **The carburetor throttle lever must be against the hot idle speed adjusting screw at the specified idle speed in D1 (large dot) or D2 (small dot).** To make sure that the carburetor throttle lever is against the idle adjusting screw, refer to Group 10 for the carburetor adjusting procedures.
6. With the engine off, check the accelerator pedal for a height of 4¼ inch, measured from the top of the pedal to the floor pan. To obtain the correct pedal height, adjust the accelerator connecting link.
7. With the engine off, at the adjustable upper end of the downshift rod loosen the lock nut (Fig. 13).
8. With the carburetor choke in the OFF position, depress the accelerator pedal to the floor. Block the pedal to hold it in the wide open positon.
9. Adjust the downshift rod to position the rod in the kickdown detent position. The rod has to be lengthened to the limit of its travel.
10. Back off the adjustment to allow about 1/16 inch free travel of the bellcrank assembly. Tighten the lock nut and release the accelerator pedal. Road test the car for forced downshift operation.

MANUAL LINKAGE ADJUSTMENT

1. With the engine stopped, loosen the clamp at the shift lever at point "A" so that the shift rod is free to slide in the clamp (Fig. 14).
2. Position the transmission selector lever into the D1 (large dot) position.
3. Shift the manual lever at the transmission into the D1 detent position, second from the rear.
4. Tighten the clamp on the shift rod at point "A".
5. Check the pointer alignment and transmission operation for all selector lever detent positions.

NEUTRAL START SWITCH ADJUSTMENT

1. With the manual lever properly adjusted, loosen the two switch retaining bolts (Fig. 15).
2. With the transmission manual

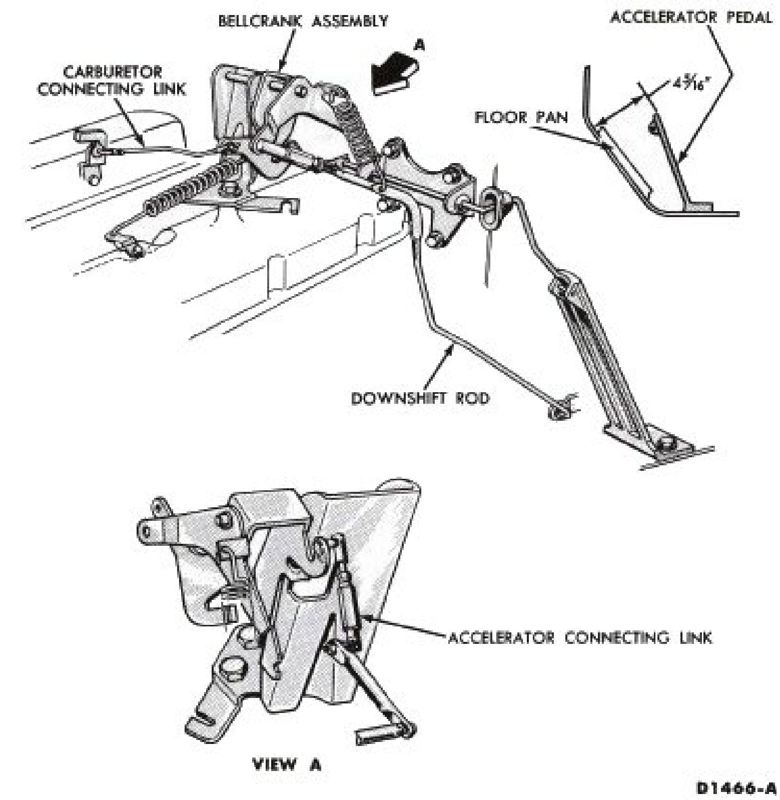


FIG. 13—Throttle Linkage

lever in neutral, rotate the switch and insert the gauge pin (No. 43 drill shank end) into the gauge pin holes of the switch. **The gauge pin has to be inserted to a full $\frac{31}{64}$ inch into the three holes of the switch (Fig. 15).**

3. Torque the two switch retaining bolts to specification. Remove the gauge pin from the switch.

4. Check the operation of the switch. The engine should start only with the transmission selector lever in Neutral and Park.

NEUTRAL START SWITCH REPLACEMENT

1. Remove the downshift linkage rod from the transmission downshift lever.

2. Remove the transmission downshift outer lever retaining nut and lever (Fig. 15).

3. Remove the two neutral start switch retaining bolts.

4. Disconnect the two multiple wire connectors. Remove the neutral switch from the transmission.

5. Install the neutral start switch on the transmission. Install the two retaining bolts.

6. With the transmission manual lever in neutral, rotate the switch and install gauge pin (No. 43 drill) into the gauge pin holes (Fig. 15).

7. Tighten the switch retaining bolts to specification and remove the gauge pin.

8. Install the outer downshift lever and retaining nut, and torque the nut to specification. Install the downshift linkage rod to the downshift lever.

9. Install the switch wires. Connect the wire multiple connectors, red to red and blue to blue. Check the operation of the switch in each detent position. The engine should start only with the transmission selector lever in N (neutral) and P (park).

BAND ADJUSTMENTS

INTERMEDIATE BAND

1. Clean all the dirt from the band adjusting screw area. Loosen the lock nut several turns.

2. With the tool shown in Fig. 16, tighten the adjusting screw until the tool handle clicks. The tool is a pre-

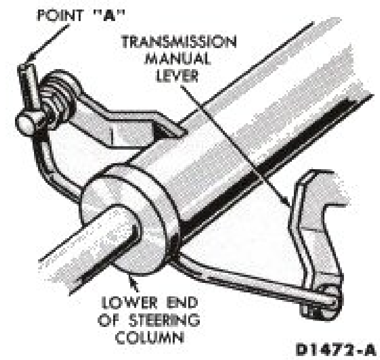


FIG. 14—Manual Linkage

set torque wrench which clicks and overruns when the torque on the adjusting screw reaches 10 ft-lbs.

3. **Back off the adjusting screw exactly 1½ turns.**

4. Hold the adjusting screw from turning and torque the locknut to specification.

LOW-REVERSE BAND

1. Clean all the dirt from the band adjusting screw area. Loosen the lock nut several turns.

2. With the tools shown in Fig. 17 tighten the adjusting screw until the tool handle clicks. The tool is a preset torque wrench which clicks and overruns when the torque on the adjusting screw reaches 10 ft-lbs.

3. **Back off the adjusting screw exactly 3 full turns.**

4. Hold the adjusting screw from turning and torque the lock nut to specification.

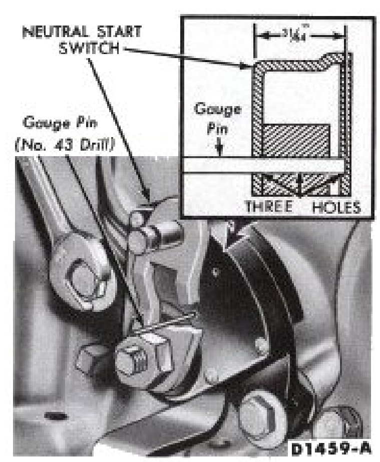


FIG. 15—Neutral Start Switch

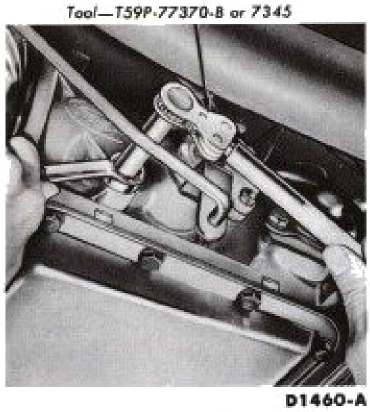


FIG. 16—Intermediate Band Adjustment

OIL PAN AND CONTROL VALVE BODY REPLACEMENT

1. Raise the car so the transmission oil pan is accessible.

2. Loosen the oil pan retaining bolts and lower one edge of the oil pan to drain the transmission oil. **If the same fluid is to be used again, filter the fluid through a 100 mesh screen. Re-use the fluid only if it is in good condition.**

3. Remove the 11 transmission oil pan retaining bolts, oil pan and gasket.

4. Remove the eight valve body to case retaining bolts (Fig. 28). Remove the valve body from the case and the inner transmission control levers.

5. Refer to the "Major Repair Operation" for control valve body repair operation.

6. Thoroughly clean and remove all the gasket material from the oil pan and the oil pan mounting face of the case. Install the valve body to the case, engaging the transmission inner control levers with the valve body manual and downshift valves.

7. Install the eight valve body to case retaining bolts. Torque the bolts to specification. **Operate the external manual and downshift levers to check for proper travel of the valve body manual and downshift valves.**

8. Place a new gasket on the oil pan. Install the oil pan and 11 retaining bolts. Torque the bolts to specification.

9. Lower the car and fill the transmission with fluid. Check the transmission oil pan area for oil leakage.

FIG. 17—Low-Reverse Band Adjustment

INTERMEDIATE SERVO REPAIR

1. Raise the car and remove the four servo cover to case retaining bolts.

2. Remove the servo cover, gasket, piston, and piston return spring. Remove the piston from the cover (Fig. 48).

3. Remove the piston seals and cover gasket.

4. Install new piston seals on the piston. Lubricate the piston seals with clean transmission oil. Install the servo piston in the cover.

5. Install the piston return spring in the case. Place a new gasket on the cover. Install the piston and cover into the transmission case. Use two 5/16-18x1¼ bolts, 180° apart to position the cover against the case.

6. Install the two servo cover retaining bolts. Remove the two 1¼ inch bolts and install two retaining bolts. Torque the bolts to specification.

7. Adjust the intermediate band. Lower the car and check the transmission fluid level.

8. If the band can not be adjusted properly, the struts are not in position. Remove the oil pan and valve body. Install the struts, valve body, oil pan, and adjust the band. Refill the transmission with oil.

LOW-REVERSE SERVO PISTON REPLACEMENT

1. Raise the car and remove the four servo cover to case retaining bolts. Remove the identification tag and vent tube retaining clip. Remove the servo cover from the case.

2. With the piston stem in the case, move the piston out as far as possible and insert a small screwdriver in the hole of the piston stem (Fig. 47). Remove the piston retaining nut.

3. Remove the servo piston from the case. **The piston seal cannot be replaced without replacing the piston. The seal is bonded to the piston.**

4. Install a new piston on the piston retaining shaft. Install the retaining nut. Torque the nut to specification.

5. Install the piston into the case. Install a new seal on the cover. Install the cover by using two 5/16-18 bolts 1¼ inch long, 180° apart to position the servo cover on the case. Install the vent tube retaining clip and identification tag. Install two cover retaining bolts. Remove the two installing bolts and install the last two retaining bolts. Torque the cover to case retaining bolts to specificaion.

6. Adjust the low-reverse band. Lower the car and check the transmission fluid level.

7. If the band cannot be adjusted properly, the struts are not in position. Remove the oil pan and valve body. Install the struts, valve body, oil pan, and adjust the band. Refill the transmission with oil.

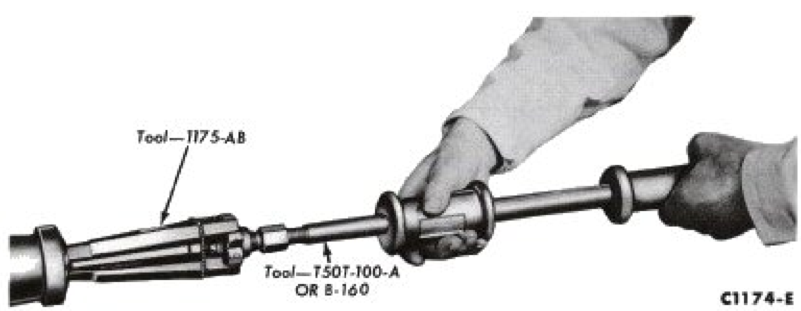


FIG. 18—Extension Housing Seal Removal

FIG. 19—Extension Housing Bushing Removal

EXTENSION HOUSING BUSHING AND REAR SEAL REPLACEMENT

1. Disconnect the drive shaft from the transmission.

2. When only the rear seal needs replacing, carefully remove it with a tapered chisel or the tools shown in Fig. 18. Remove the bushing as shown in Fig. 19. **Use the bushing remover carefully so that the spline seal is not damaged.**

3. When installing a new bushing use the special tool shown in Fig. 20.

4. Before installing a new seal, inspect the sealing surface of the universal joint yoke for scores. If scores are found, replace the yoke.

5. Inspect the counterbore of the housing for burrs and remove with crocus cloth.

6. Install the seal into the housing with the tool shown in Fig. 21. The seal should be firmly seated in the bore. Coat the inside diameter of the fiber portion of the seal with B8A-19589-A lubricant.

7. Coat the front universal joint spline with B8A-19589-A lubricant and install the drive shaft.

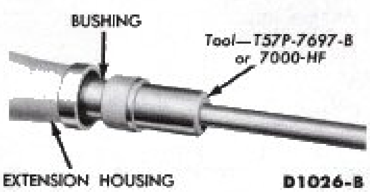


FIG. 20—Extension Housing Bushing Installation

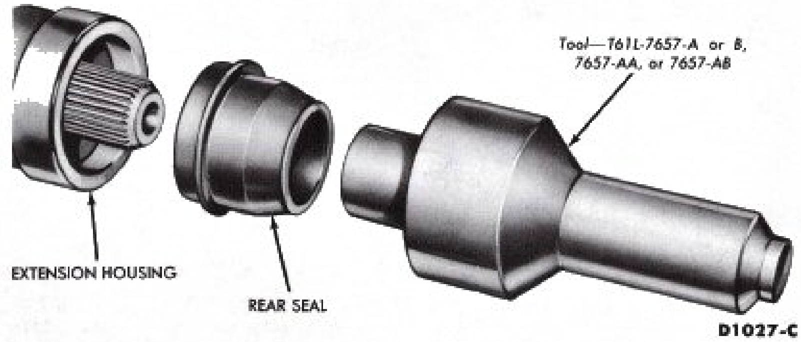


FIG. 21—Extension Housing Rear Seal Installation

EXTENSION HOUSING AND GOVERNOR REPLACEMENT

1. Raise the car on the hoist.

2. Remove the drive shaft. Position the transmission jack to support the transmission.

3. Remove the speedometer cable from the extension housing.

4. Remove the extension housing to crossmember mount retaining bolts. Raise the transmission and remove the mounting pad between the extension housing and the crossmember.

5. Loosen the extension housing retaining bolts to drain the transmission fluid. Disconnect the exhaust inlet pipes at the manifold and lower the inlet pipes.

6. Remove the six extension housing-to-case retaining bolts and remove the extension housing.

7. Remove the governor housing to governor distributor retaining bolts (Fig. 22). Remove the governor housing from the distributor.

8. Refer to "Major Repair Operations" for governor repair operations.

9. Install the governor housing on the governor distributor (Fig. 22). Install the retaining bolts and torque the bolts to specification.

10. Install a new extension housing gasket on the case. Install the extension housing and six retaining bolts. Torque the bolts to specification.

11. Install the transmission mounting pad to the crossmember. Lower the transmission and install the extension housing to crossmember retaining bolts. Torque the retaining bolts to specification. Remove the transmission jack.

12. Install the speedometer cable in the extension housing. Install the drive shaft.

13. Install the inlet pipes on the manifold.

14. Lower the car and fill the transmission with fluid.

15. Check the extension housing area for fluid leakage.

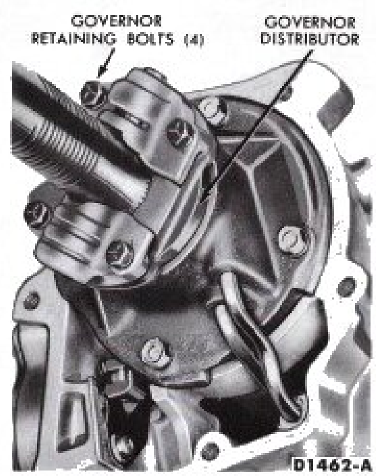


FIG. 22—Governor Location

3 REMOVAL AND INSTALLATION

REMOVAL

1. Raise the car and remove the three converter cover retaining bolts, at the lower front side of the converter housing. Remove the cover.

2. Remove the two converter drain plugs (Fig. 23). Drain the oil from the converter. Install the two converter drain plugs.

3. Remove the drive shaft and install the extension housing seal replacer tool in the extension housing.

4. Remove the vacuum line hose from the transmission vacuum unit. Disconnect the vacuum line from the retaining clip.

5. Remove the two extension housing to crossmember bolts.

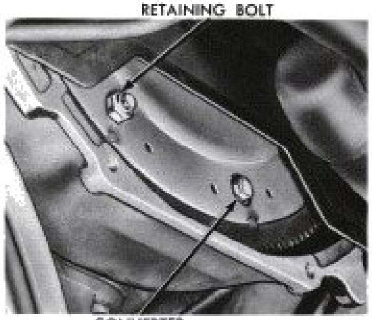


FIG. 23—Converter Drain Plug Location

6. Remove the speedometer cable from the extension housing.
7. Disconnect the exhaust pipe flange from the manifolds.
8. Remove the parking brake cable from the equalizer lever.
9. Loosen the 11 transmission oil pan bolts and drain the oil at one corner of the oil pan. Tighten the retaining bolts.
10. Disconnect the oil cooler lines from the transmission case. Remove the oil filler tube from the case.
11. Remove the manual and kick-down linkage rods from the transmission control levers.
12. Remove the transmission outer downshift lever and the neutral start switch (Fig. 15).
13. Remove the starter cable. Remove the starter retaining bolts and remove the starter from the converter housing.
14. Remove the four converter to flywheel retaining nuts.
15. Position the transmission jack to support the transmission and secure the transmission to the jack with a safety chain.
16. Remove the four crossmember and mounting pad retaining bolts and lower the crossmember.
17. Remove the five converter housing to engine retaining bolts. Lower the transmission (Fig. 24) and remove it from under the car.

INSTALLATION

1. With the converter properly installed place the transmission on the jack (Fig. 24). Secure the transmission to the jack with the safety chain.
2. Raise the transmission into position and install the five converter housing to engine retaining bolts. Torque the bolts to specification. Remove the safety chain from the transmission.
3. Position the crossmember and mounting pad into position and install the four retaining bolts. Torque the bolts to specifications.
4. Lower the transmission and install the extension housing and crossmember retaining bolts. Torque the bolts to specification.
5. Install the four flywheel to converter retaining nuts. Torque the nuts to specification.
6. Remove the transmission jack. Install the vacuum hose on the transmission vacuum unit. Install the vacuum line retaining clip.
7. Install the transmission oil filler tube. Connect the oil cooling lines to the transmission case.
8. Install the neutral start switch, and adjust the switch (Fig. 15) as outlined under In-Car Adjustments and Repairs. Torque the retaining bolts to specification. Install the transmission outer downshift lever. Torque the retaining nut to specification.

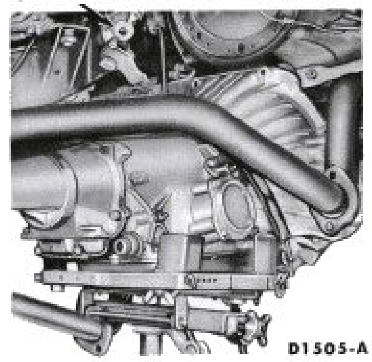


FIG. 24—Transmission Mounted on Jack

9. Install the linkage rods on the transmission downshift and manual control levers.
10. Install the speedometer cable on the extension housing.
11. Connect the exhaust inlet pipes to the manifolds.
12. Install and adjust the parking brake cable at the equalizer lever.
13. Install the converter housing cover and torque the retaining bolts to specification.
14. Install the starter and torque the retaining bolts to specification. Install the starter cable.
15. Install the drive shaft. Torque the companion flange U-bolts retaining nuts to specification.
16. Lower the car and fill the transmission with fluid. Adjust the manual and kickdown linkage.

4 MAJOR REPAIR OPERATIONS

Before removing any of the sub-assemblies, thoroughly clean the outside of the transmission to prevent dirt from entering the mechanical parts. During the repair operations, refer to Part 7-1 for common adjustments and repairs or cleaning and inspection procedures.

During the transmission disassembly or assembly operations, ten thrust washers located between the sub-assemblies must be removed and installed. It is important that each thrust washer be in the correct position during the assembly operation. To properly locate and identify the thrust washers, the various positions of the thrust washers are shown in the illustrations and are numbered 1 through 10. Number 1 is the first thrust washer located at the front pump. The last thrust washer, No. 10, is located at the parking gear.

DISASSEMBLY

1. Remove the converter from the transmission front pump and converter housing.
2. Remove the transmission vacuum unit with the tool shown in Fig. 25. Remove the vacuum unit gasket and control rod.
3. From the vacuum unit hole in the case, remove the primary throttle valve (Fig. 26).
4. Remove the two extension housing to case retaining bolts and mount the transmission in the holding fixture as shown in Fig. 27.
5. Remove the 11 oil pan retaining bolts, and the oil pan and gasket.
6. Remove the eight control valve body retaining bolts (Fig. 28). Remove the control valve body from the case.

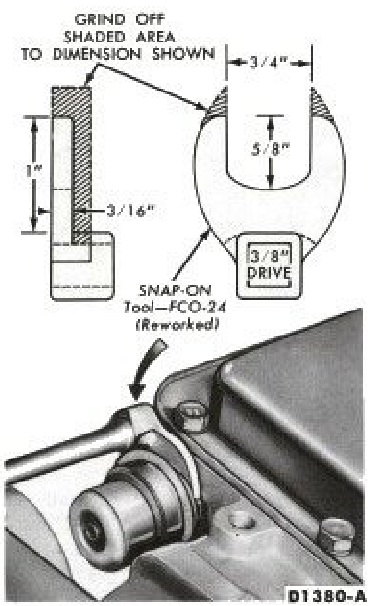


FIG. 25—Vacuum Unit Removal

7. Loosen the intermediate band adjusting screw (Fig. 29) and remove the intermediate band struts from the case. Loosen the low-reverse band adjusting screw and remove the low-reverse band struts (Fig. 29).

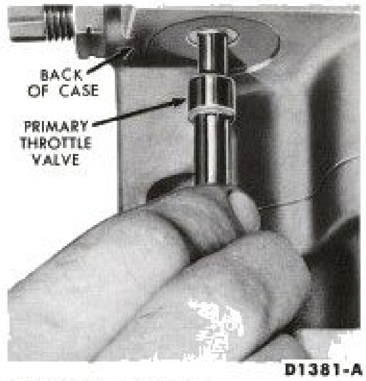


FIG. 26—Primary Throttle Valve Removal or Installation

TRANSMISSION END PLAY CHECK

1. To keep the output shaft in alignment during the end play check, install the extension housing oil seal replacer tool or a front universal joint yoke in the extension housing.

2. Remove one of the converter housing and front pump to case retaining bolts and mount the dial indicator as shown in Fig. 30.

3. The input shaft is a loose part and has to be properly engaged with the spline of the forward clutch hub

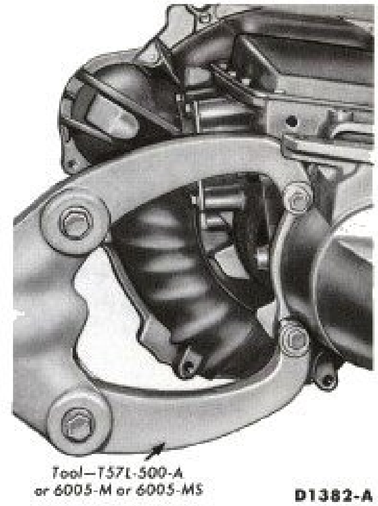


FIG. 27—Transmission Mounted in Holding Fixture

during the end play checking procedure. Move the input shaft and gear train toward the back of the transmission case.

4. With the dial indicator contacting the end of the input shaft, set the indicator at zero (Fig. 30).

5. Insert a screwdriver behind the input shell (Fig. 30). Move the input shell and the front part of the gear

FIG. 28—Control Valve Body Retaining Bolts

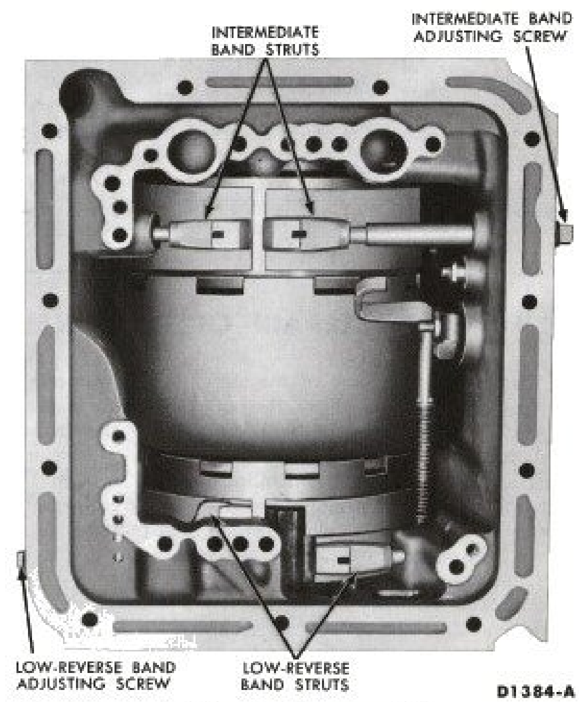


FIG. 29—Band Adjusting Screws and Struts

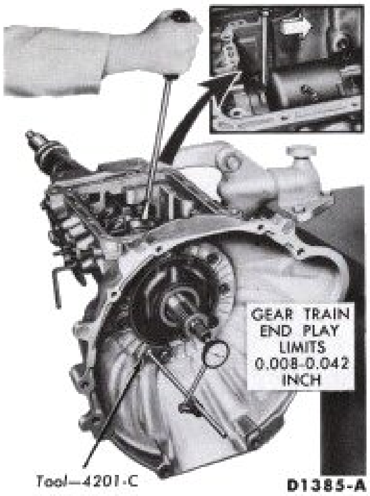


FIG. 30—End Play Check

train forward.

6. Record the dial indicator reading. The end play should be 0.008 to 0.042 inch. If the end play is not within specifications, **both selective thrust washers (Fig. 31) must be replaced. The selective thrust washers cannot be replaced individually.**

When it is necessary to change thrust washers, use the selective thickness of thrust washer No. 2 to obtain the proper end play. Fig. 31 gives the selectivity that is available to obtain the correct selective thrust washers.

7. Remove the dial indicator and remove the input shaft from the front pump stator support (Fig. 32).

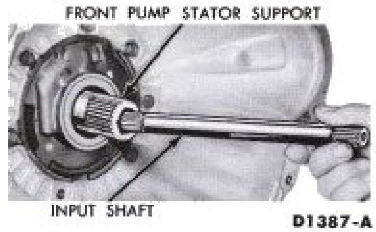


FIG. 32—Input Shaft Removal or Installation

REMOVAL OF CASE AND EXTENSION HOUSING PARTS

1. Rotate the holding fixture to put the transmission in a vertical position with the converter housing up.

2. Remove the six converter housing and front pump to case retaining bolts. Remove the converter housing from the front pump.

3. Remove the front pump by inserting a screwdriver behind the input shell (Fig. 33). Move the input shell forward until the front pump seal is above the edge of the case. Remove the front pump and gasket from the case. If the selective thrust washer No. 1 did not come out with the front pump, remove it from the top of the reverse-high clutch.

4. Remove the intermediate and low-reverse band adjusting screws from the case. Rotate the intermediate band to align the band with the clearance hole in the case (Fig. 34). Remove the intermediate band from the case. If the intermediate band is to be re-used, do not clean the band in a vapor degreaser, or with a detergent solution. Clean the band with a lint free cloth.

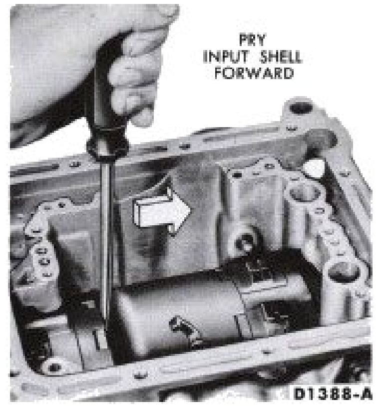


FIG. 33—Front Pump Removal

FIG. 34—Position of Intermediate Band for Removal or Installation

5. Using a screwdriver between the input shell and rear planet carrier (Fig. 35) lift the input shell upward and remove the forward part of the

SELECTIVE THRUST WASHERS

WASHER NO. 1 (FIBER)		WASHER NO. 2 (STEEL-BACK BRONZE)	
THICKNESS (INCHES)	IDENTIFICATION (DYE-COLOR)	THICKNESS (INCHES)	IDENTIFICATION (STAMPED NO.)
.038-.042	GREEN	.041-.043	1
.053-.057	TAN	.053-.056	2
.070-.074	BLACK	.073-.075	3
.087-.091	YELLOW	.090-.092	4
.104-.108	BLUE	.107-.109	5

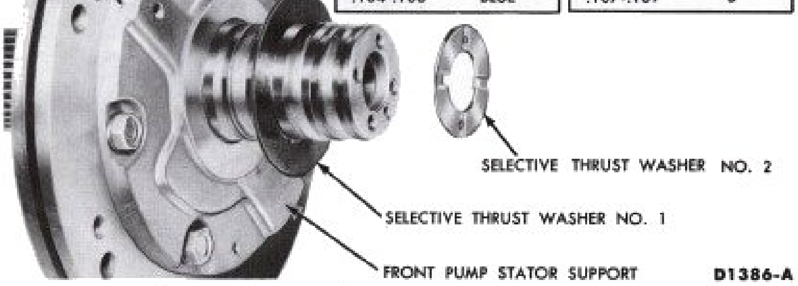


FIG. 31—Selective Thrust Washer Locations

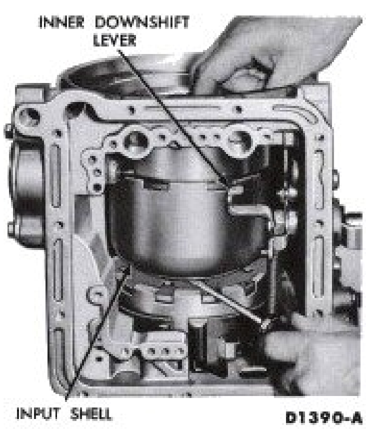


FIG. 35—Lifting Input Shell and Gear Train

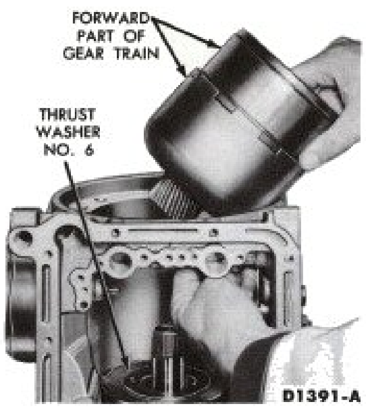


FIG. 36—Forward Part of Gear Train—Removal or Installation

gear train as an assembly (Fig. 36).

6. Place the forward part of the gear train in the holding fixture shown in Fig. 37.

7. From the gear train in the holding fixture, remove the reverse-high clutch and drum from the forward clutch (Fig. 38).

8. If thrust washer No. 2 (Fig. 31) did not come out with the front pump, remove the thrust washer from the forward clutch cylinder. Remove the forward clutch from the

FIG. 37—Forward Part of Gear Train Positioned in Holding Fixture

forward clutch hub and ring gear (Fig. 38).

9. If thrust washer No. 3 (Fig. 38) did not come out with the forward clutch, remove the thrust washer from the forward clutch hub.

10. Remove the forward clutch hub and ring gear from the front planet carrier (Fig. 38).

11. Remove thrust washer No. 4 and the front planet carrier from the input shell.

12. Remove the input shell, sun gear and thrust washer No. 5 from the holding fixture (Fig. 38).

13. From inside the transmission case, remove the inner downshift lever from the manual lever (Fig. 35). Remove thrust washer No. 6 from the top of the reverse planet carrier.

14. Remove the reverse planet carrier and thrust washer No. 7 from the reverse ring gear and hub (Fig. 39).

15. Move the output shaft forward and with the tool shown in Fig. 40 remove the reverse ring gear hub to output shaft retaining ring.

16. Remove the reverse ring gear and hub from the output shaft. Remove thrust washer No. 8 from the low and reverse drum.

17. Remove the low-reverse band from the case (Fig. 41).

18. Remove the low-reverse drum from the one-way clutch inner race (Fig. 39).

19. Remove the one-way clutch inner race by rotating the race clockwise as it is removed.

20. Remove the 12 one-way clutch rollers, springs and the spring retain-

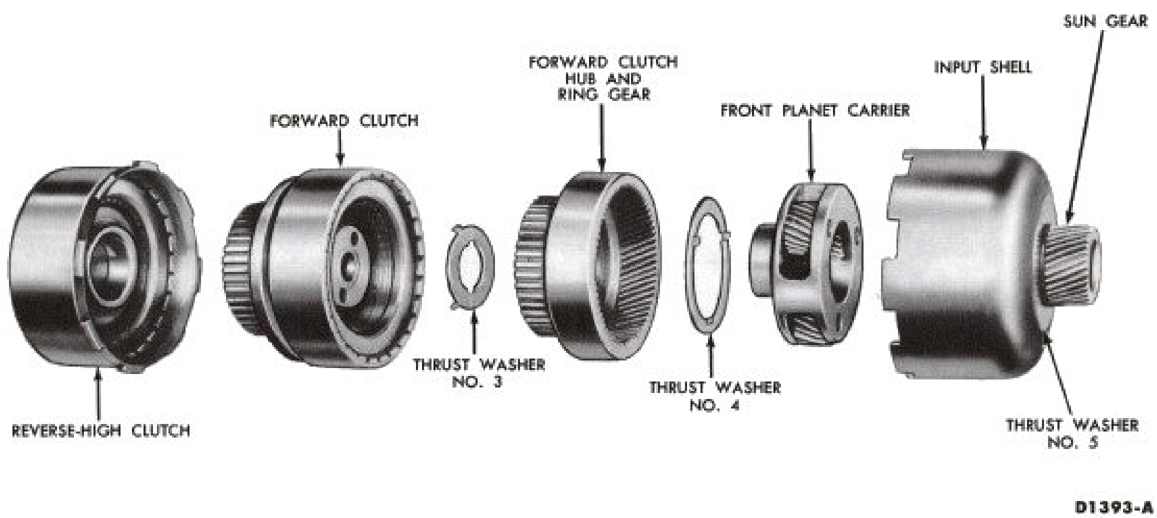


FIG. 38—Forward Part of Gear Train Disassembled

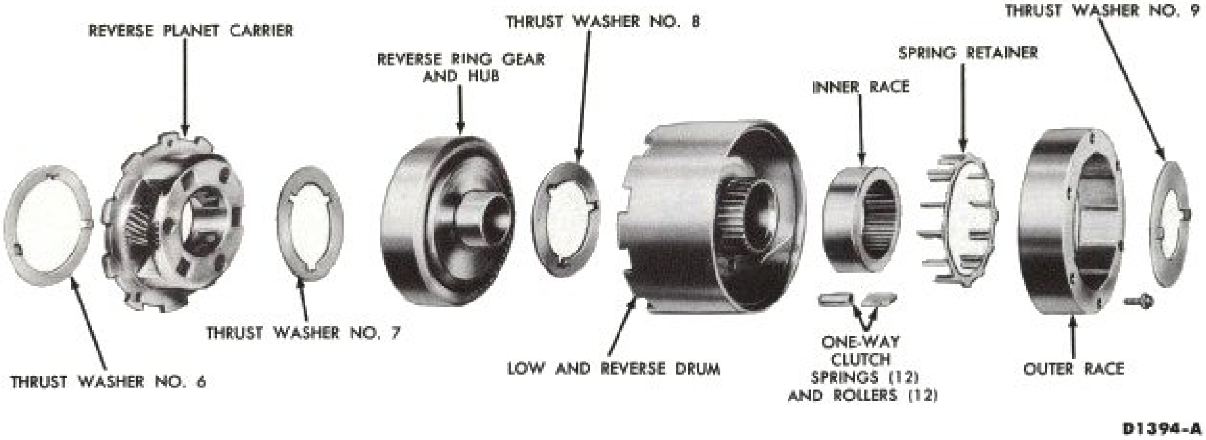


FIG. 39—Lower Part of Gear Train Disassembled

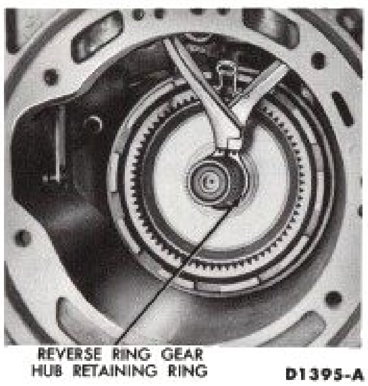


FIG. 40—Reverse Ring Gear Hub Retaining Ring Removal or Installation

er from the outer race (Fig. 39). **Do not lose or damage any of the 12 springs or rollers. The outer race of the one-way clutch cannot be removed from the case until the extension housing, output shaft and governor distributor sleeve are removed.**

FIG. 41—Low-Reverse Band Removal or Installation

21. Remove the transmission from the holding fixture. Position the transmission on the bench in a vertical position with the extension housing up. Remove the four extension housing to case retaining bolts. Remove the extension housing and gasket from the case.

22. Pull outward on the output shaft and remove the output shaft and governor distributor assembly from the governor distributor sleeve (Fig. 42).

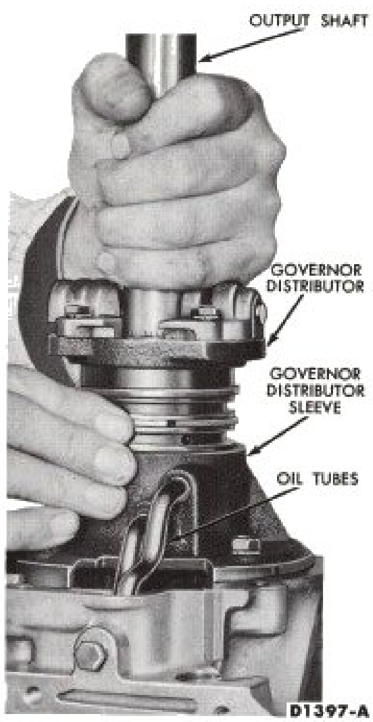


FIG. 42—Output Shaft and Governor Distributor Removal or Installation

23. Remove the governor distributor lock ring from the output shaft (Fig. 43). Remove the governor distributor from the output shaft.

24. Remove the four distributor sleeve to case retaining bolts. Remove the distributor sleeve from the case. **Do not bend or distort the oil tubes as the tubes are removed from the case with the distributor sleeve.**

25. Remove the parking pawl return spring, pawl, and pawl retaining pin from the case (Fig. 44).

26. Remove the parking pawl gear and thrust washer No. 10 from the case.

27. Remove the six one-way clutch outer race to case retaining bolts

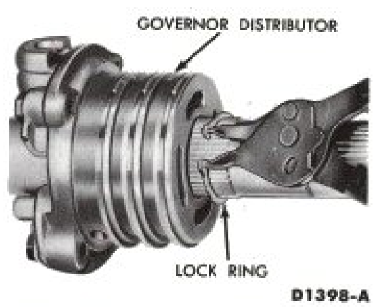


FIG. 43—Governor Distributor Lock Ring Removal or Installation

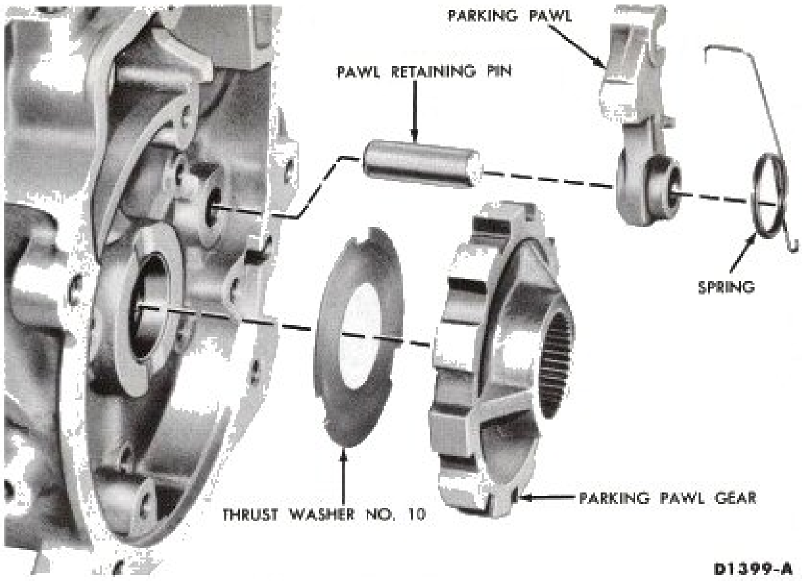


FIG. 44—Parking Pawl Return Spring, Retaining Pin and Gear

with the tool shown in Fig. 45. As the retaining bolts are removed, hold the outer race located inside the case in position. Remove the outer race and thrust washer No. 9 from the case (Fig. 39).

PARTS REPAIR OR REPLACEMENT

During the repair of the sub-assemblies, certain general instructions which apply to all units of the transmissions must be followed. These instructions are given here to avoid unnecessary repetition.

Handle all transmission parts carefully to avoid nicking or burring the bearing or mating surfaces.

Lubricate all internal parts of the transmission before assembly with clean automatic transmission fluid. **Do not use any other lubricants except on gaskets and thrust washers which may be coated with vaseline to facilitate assembly.** Always install new gaskets when assembling the transmission.

Tighten all bolts and screws to the recommended torque outlined in the Specification Section.

TRANSMISSION CASE AND LINKAGE REPAIR

Low-Reverse Servo

1. Remove the four servo cover to case retaining bolts. Remove the transmission identification tag, vent tube and retaining clip from the case.

2. Remove the servo cover, cover seal, servo piston and piston return spring from the case (Fig. 46).

3. The servo piston seal is bonded to the piston. If the seal has to be replaced, replace the piston assembly which includes the seal. Disassemble the servo piston from the piston rod by inserting a small screwdriver in the hole of the piston rod and removing the piston retaining nut (Fig. 47). Install the new servo piston and torque the piston retaining nut to specification.

4. Place the piston return spring in the servo bore of the case. Lubricate the piston seal with clean transmission oil and install the servo piston (Fig. 46).

5. Place a new cover seal on the cover and install the servo cover. Install the identification tag and the vent tube and retaining clip. Install the four cover retaining bolts. Torque the cover to case retaining bolts to specification.

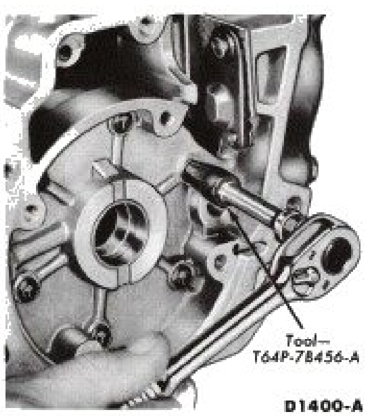


FIG. 45—One Way Clutch Outer Race Retaining Bolts Removal

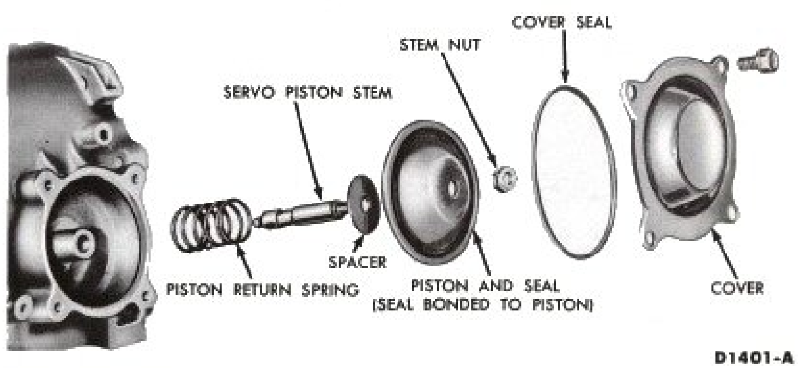


FIG. 46—Low-Reverse Servo

FIG. 47—Low-Reverse Servo Piston Removal or Installation

FIG. 48—Intermediate Servo

Intermediate Servo

1. Remove the four servo cover to case retaining bolts.

2. Remove the servo cover, gasket, servo piston and piston return spring from the case (Fig. 48).

3. Remove the piston seals from the servo piston and the gasket from the cover.

4. Install a new seal on the servo piston. Figure 49 shows the correct servo piston and cover for each transmission model. Lubricate the seals with clean transmission oil.

5. Install the gasket on the servo cover. Be careful not to damage the gasket.

6. Install the piston return spring and piston into the servo bore of the case.

7. Position the cover on the case. Use two 5/16-18 bolts, 1¼ inch long, 180° apart to position the cover against the case. Install the two cover retaining bolts. Remove the two 1¼-inch bolts and install the other two cover retaining bolts. Torque the cover retaining bolts to specification.

Downshift and Manual Linkage

1. The downshift outer and inner levers have been removed from the case during transmission removal and disassembly operations. From inside the transmission case, remove the upper retaining ring and flat washer from the manual lever link (Fig. 50). Remove the upper end of the lever link from the case retaining pin.

2. From the back of the transmission case, remove the upper retaining ring and flat washer from the

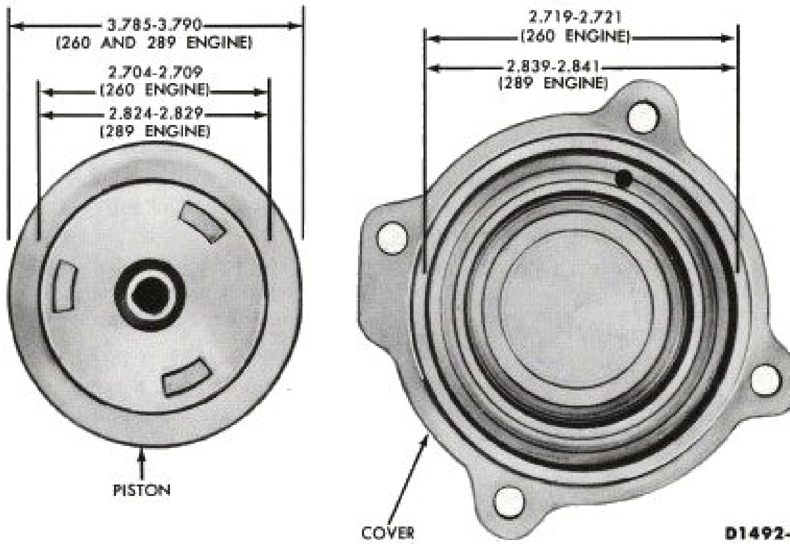


FIG. 49—Intermediate Servo Piston and Cover Identification

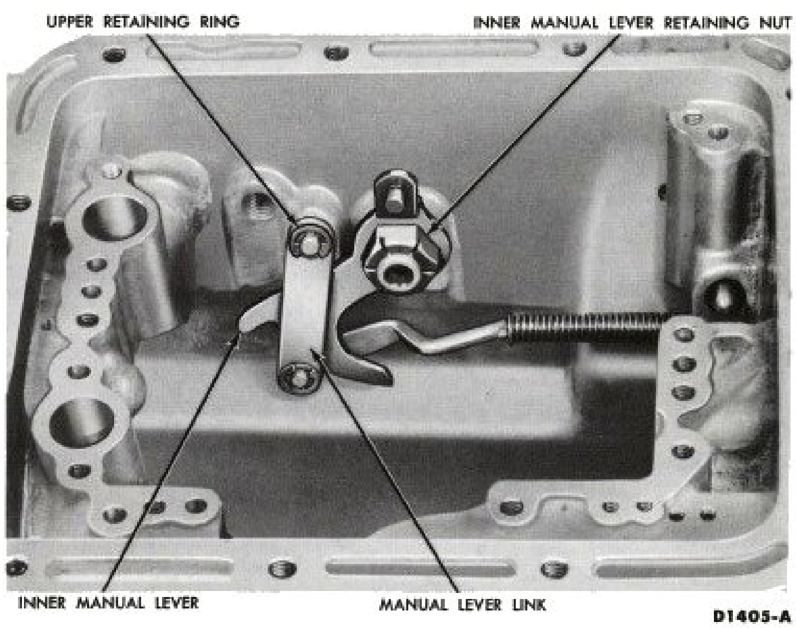


FIG. 50—Case Internal Linkage

parking pawl link (Fig. 51). Remove the pawl link and spacer from the case retaining pin.

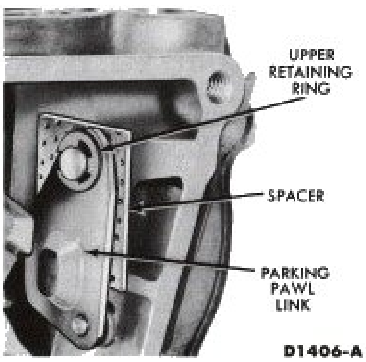


FIG. 51—Parking Pawl Link and Spacer

3. From the back of the transmission case, remove the parking pawl link, toggle rod, and manual lever link as an assembly (Fig. 52).

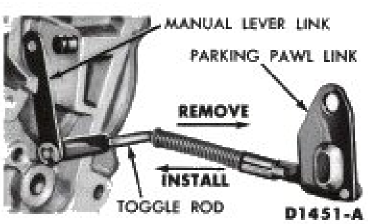


FIG. 52—Parking Pawl Toggle Rod Assembly Removal or Installation

4. Remove the rear parking pawl link lower retaining ring, flat washer and link from the toggle rod (Fig. 53).

5. Remove the manual lever link lower retaining ring, flat washer and link from the toggle rod.

6. Remove the inner manual lever retaining nut and lever. Remove the outer manual lever from the case.

7. To remove the manual lever seal, use the tools shown in Fig. 54. To install the new seal, use the tool shown in Fig. 55.

8. Install the outer manual lever

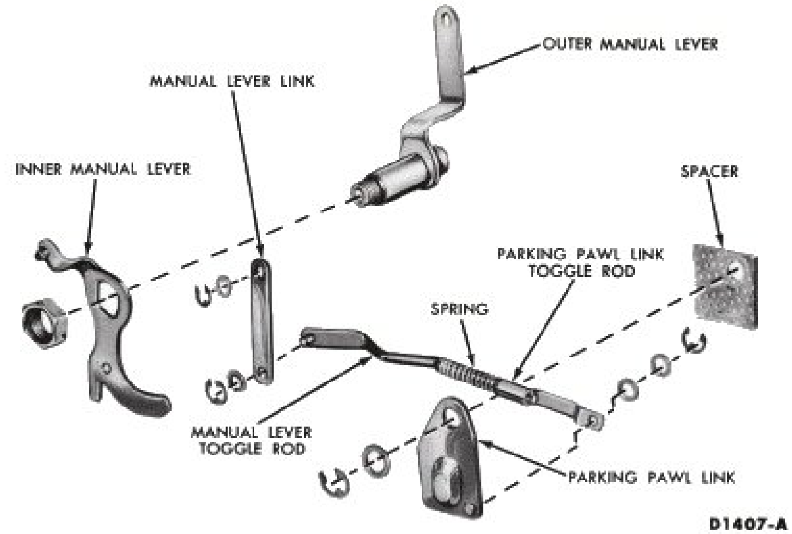


FIG. 53—Case Linkage

in the case. Install the inner manual lever and retaining nut (Fig. 50). Torque retaining nut to specification.

9. From the back of the transmission case, install the parking toggle rod and link assembly into the case (Fig. 52). Install the parking pawl link spacer onto the case retaining pin (Fig. 51). The dimpled side of

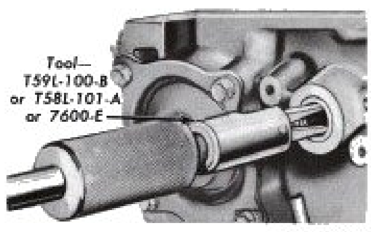


FIG. 54—Removing Manual Lever Seal

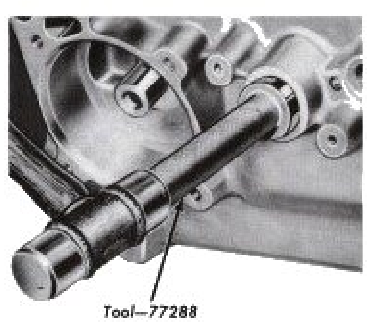


FIG. 55—Installing Manual Lever Seal

the spacer should be facing the center of the transmission case.

10. Install the parking pawl link on the case retaining pin. Install the flat washer and link retaining ring (Fig. 51).

11. Position the inner manual lever behind the manual lever link, **with the cam of the lever contacting the lower link pin (Fig. 56).**

12. Install the upper end of the manual lever link on the case retaining pin. Install the flat washer and retaining ring.

13. Operate the manual lever and check for correct linkage operation.

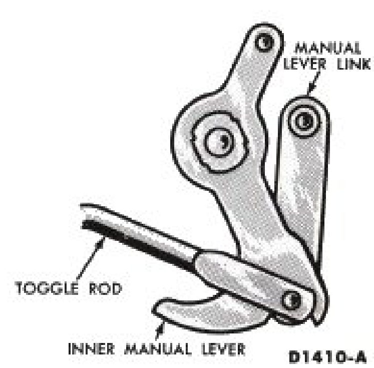


FIG. 56—Inner Manual Lever Location—As Viewed from the Control Lever Side of the Case

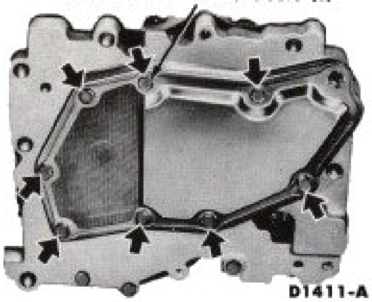


FIG. 57—Oil Screen Retaining Bolt Location

CONTROL VALVE BODY

Disassembly

1. Remove the eight oil screen retaining bolts and remove the oil screen from the valve body (Fig. 57).

2. To remove the manual valve, depress the detent spring with the tool shown in Fig. 58. Remove the spring retaining pin from the housing and remove the detent spring and plunger.

3. Remove the three cover plate retaining screws, cover plate, and the manual valve (Fig. 59).

4. Remove the secondary throttle valve and spring. Remove the throttle booster valve and spring.

5. Remove the two cover plate retaining screws, cover plate, 2-3 back-out valve, spring, and plug (Fig. 59).

6. Remove the cut-back valve and spring.

7. Remove the one hold-down plate retaining screw and hold-down plate (Fig. 62). Remove the three cover plate retaining screws, cover plate, and the 2-3 shift valve and spring (Fig. 59). Remove the throttle modulator valve and spring.

8. Remove the 1-2 shift valve and spring.

9. Remove the two cover plate retaining screws, cover plate, 3-2 coasting control valve and spring (Fig. 59).

10. Remove the three cover plate retaining screws, cover plate, pressure booster valve, valve sleeve, spring spacer and spring (Fig. 59).

11. Remove the control pressure regulator valve.

12. Remove the control pressure reducer valve and spring.

13. To separate the upper and lower valve bodies, remove the two retaining screws from the upper valve body. Remove the seven retaining screws from the lower valve body.

With the lower valve body positioned upward, separate the upper and lower valve bodies. **Do not lose the check ball(s) or spring from the upper body (Fig. 60).**

14. Remove the hold-down plate retaining screws and plate from the lower valve body. Remove the separator plate and gasket from the lower body (Fig. 61).

15. Remove the emergency relief valve check ball and spring from the upper body. Remove the shuttle valve ball from the valve body (Fig. 60).

16. Remove the downshift valve spring stop (Fig. 60). Remove the downshift valve and spring.

Assembly

1. Position the gasket and separator plate on the lower valve body (Fig. 61). As the valves are installed, check the free travel of each valve in the bore of the valve body. Install the hold-down plate and two retaining screws (Fig. 62). Torque the screws to specifications.

2. In the upper valve body, install the downshift valve and spring. Compress the spring and install the spring retainer (Fig. 60).

3. Install the emergency release valve spring and check valve ball on top of the spring. Install the shuttle valve check ball (Fig. 60).

4. Position the lower valve body and separator plate onto the upper body. Install the seven retaining screws. Turn the valve body over and install two retaining screws. **Torque all the retaining screws to specifications.** As each valve is installed check the free travel of the valve in the bore of the casting.

5. Install the control pressure reducer valve and spring in the upper valve body (Fig. 59).

6. Install the control pressure regulator valve, spring, spring spacer, pressure booster valve and sleeve.

7. Install the cover plate on the end of the pressure booster valve sleeve and torque the three retaining screws to specification.

8. Install the 3-2 coasting control valve and spring. Install the cover plate and torque the two retaining screws to specification (Fig. 59).

9. Install the 1-2 shift valve spring and valve. Install the throttle modulator valve and spring and the 2-3 shift valve spring and valve (Fig. 59). Install the cover plate and torque the three retaining screws to specifications. Install the hold down plate and retaining bolt (Fig. 62). Torque the retaining bolt to specifications. Install the cut-back valve and install the spring cover plate and torque the two cover plate retaining screws to specification (Fig. 59).

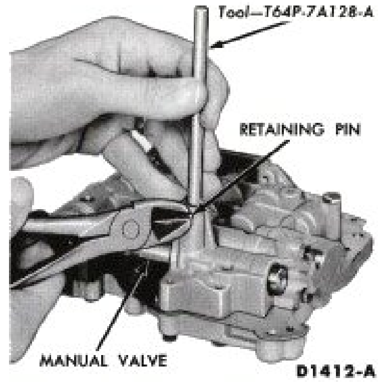


FIG. 58—Manual Valve Detent Spring Removal or Installation

10. To install the manual valve, place the valve in the upper body with the detents in alignment with the top of the housing. Install the detent plunger and spring. To install the detent spring lock pin, use the tool shown in Fig. 58. Compress the detent spring and install the spring lock pin.

11. Install the secondary throttle valve spring and valve. Install the throttle booster valve spring and valve. Install the cover plate and torque the three retaining bolts to specification.

12. Place the screen on the lower valve body and install the retaining bolts (Fig. 57). Torque the bolts to specification.

FRONT PUMP

1. Remove the four seal rings from stator support and the O-ring seal from the pump housing.

2. Remove the five bolts that retain the stator support to the front pump housing. Remove the stator support from the pump housing (Fig. 63).

3. Remove the drive and driven

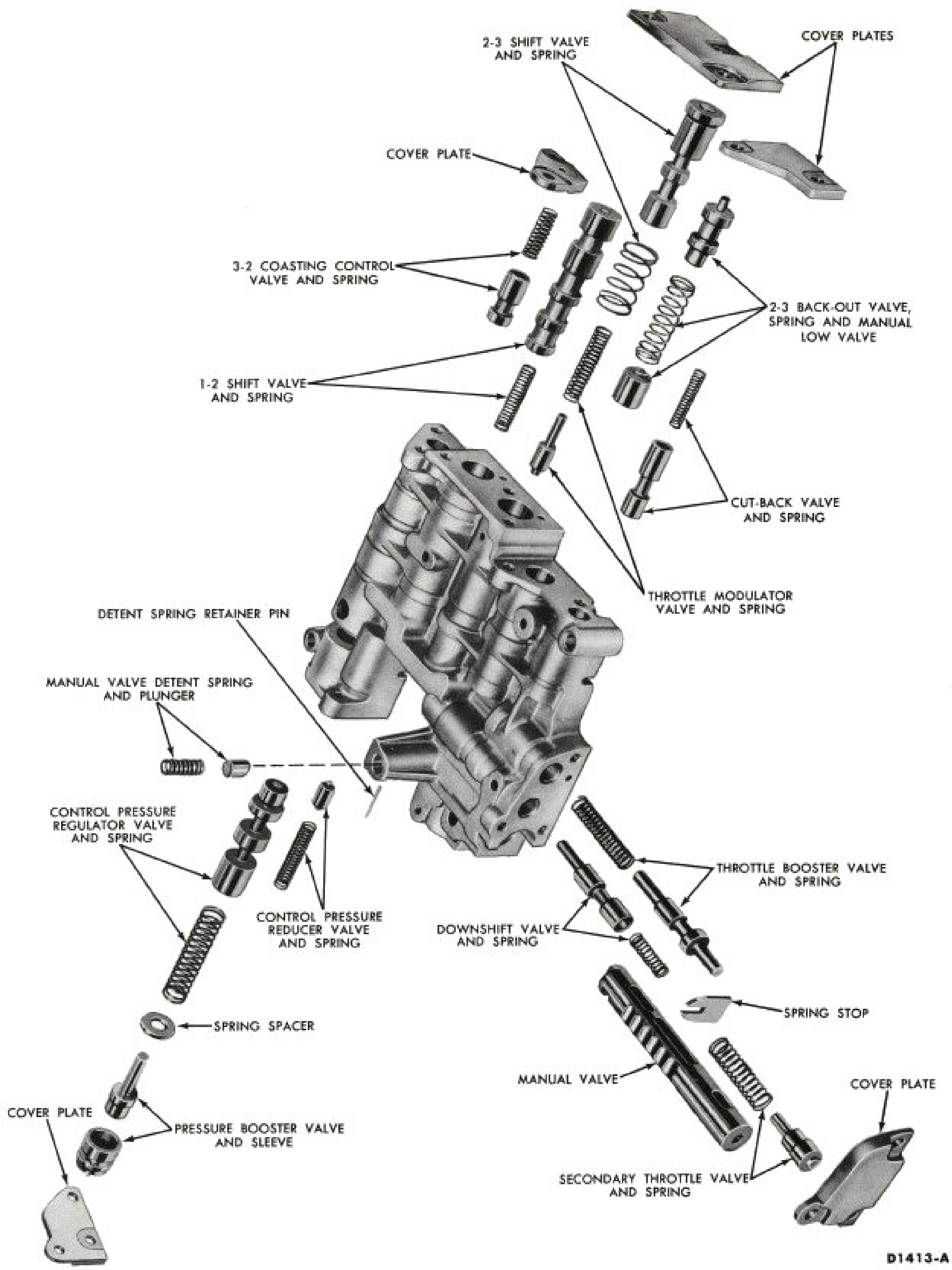


FIG. 59—Upper Valve Body Disassembled

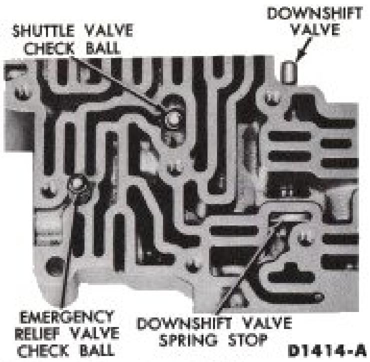


FIG. 60—Upper Valve Body Check Ball and Spring Location

gears from the front pump housing.

4. Install the drive and driven gears in the pump housing. Each gear has an identification mark on the side of the gear teeth that are chamfered. **The chamfered side**

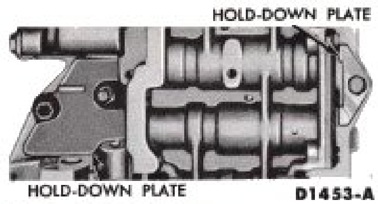


FIG. 62—Hold Down Plate Location

with the identification mark has to be positioned downward against the face of the pump housing.

5. Place the stator support in the pump housing and install the five retaining bolts. Torque the bolts to specifications.

6. Install the four seal rings on the stator support. The two large oil rings are assembled first in the oil ring grooves toward the front of the stator support. Install the O-ring seal on the pump housing (Fig. 63).

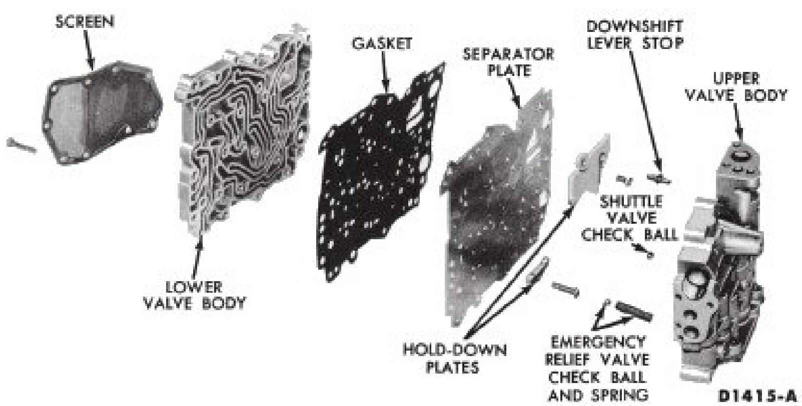


FIG. 61—Upper and Lower Valve Bodies Separated

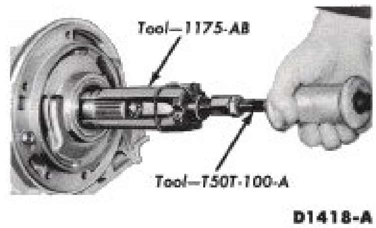


FIG. 64—Front Pump Seal Removal

7. Check the pump gears for free rotation by placing the pump on the converter drive hub in its normal running position and turning the pump housing.

8. If the front pump seal must be replaced, mount the pump in the transmission case and remove the seal with the tool shown in Fig. 64. To install the new seal use the tool shown in Fig. 65.

REVERSE-HIGH CLUTCH

1. Remove the pressure clutch retaining snap ring (Fig. 67).

2. Remove the pressure plate, and the drive and driven clutch plates

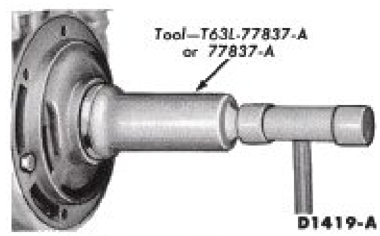


FIG. 65—Front Pump Seal Installation

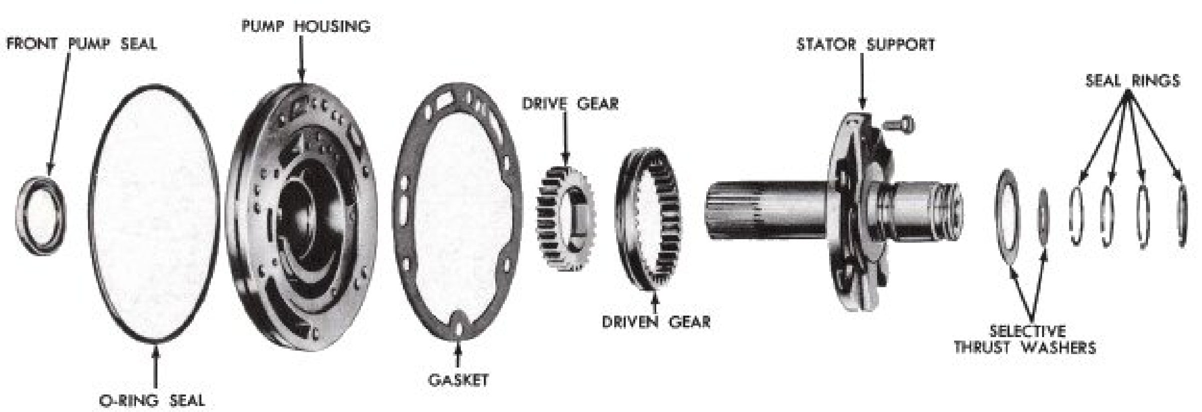


FIG. 63—Front Pump and Stator Support Disassembled

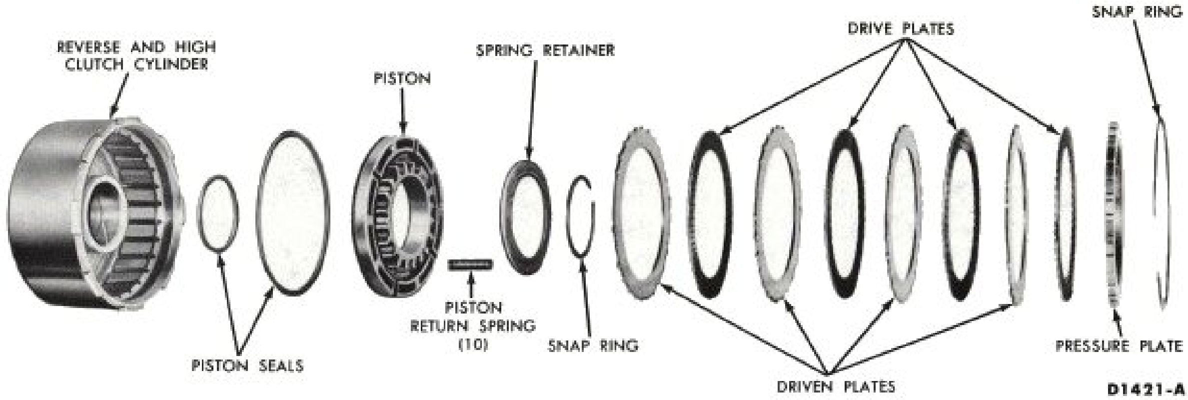


FIG. 66—Reverse-High Clutch Disassembled

(Fig. 66). If the composition clutch plates are to be reused, do not clean the plates in a vapor degreaser or with a detergent solution. Wipe the plates clean with lint-free cloth.

3. To remove the piston spring retainer snap ring, place the clutch hub in the arbor press. With the tools shown in Fig. 68, compress the piston return springs and remove the snap ring. When the arbor press ram is released, guide the spring retainer to clear the snap ring groove of the drum.

4. Remove the spring retainer and ten piston return springs.

5. Remove the piston by inserting air pressure in the piston apply hole of the clutch hub (Fig. 69).

6. Remove the piston outer seal from the piston and the piston inner seal from the clutch drum (Fig. 66).

7. Install a new inner seal in the clutch drum and a new outer seal on the clutch piston (Fig. 66). Lubricate the seals with clean transmission oil and install the piston into the clutch drum.

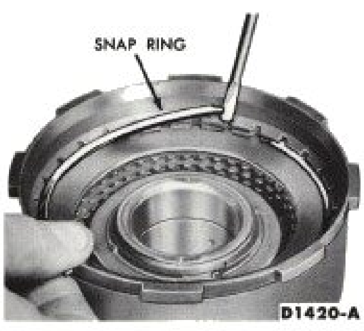


FIG. 67—Reverse-High Clutch Pressure Plate Snap Ring Removal or Installation

8. Place the ten clutch piston springs into position on the clutch piston. Place the spring retainer on top of the springs. To install the snap ring, use the tools shown in Fig. 68. As the press ram is moved downward, make sure the spring retainer is centered to clear the drum. Install the snap ring. **Before the press ram is released make sure the snap ring is positioned inside of the four snap ring guides on the spring retainer.**

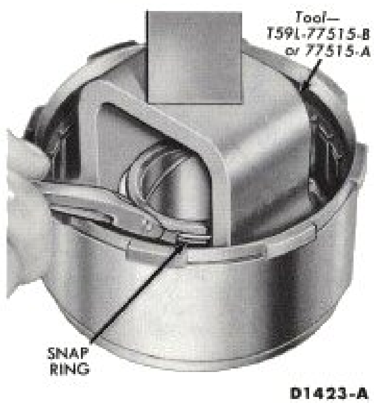


FIG. 68—Clutch Piston Spring Retainer Snap Ring Removal or Installation

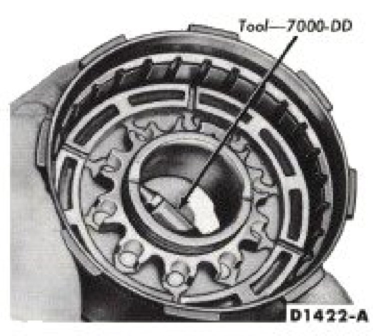


FIG. 69—Reverse-High Clutch Piston Removal

9. When new composition clutch plates are used, soak the plates in transmission oil for fifteen minutes before the plates are assembled. Install the clutch plates alternately by starting first with a steel plate then a non-metallic plate (Fig. 66). The last plate installed is the pressure plate with the internal chamfered side up. For the correct number of clutch plates required for each transmission model, refer to Part 7-4.

10. Install the pressure plate retaining snap ring (Fig. 67). Make sure the snap ring is fully seated in the snap ring groove of the clutch hub.

FORWARD CLUTCH

1. Remove the clutch pressure plate retaining snap ring (Fig. 70).

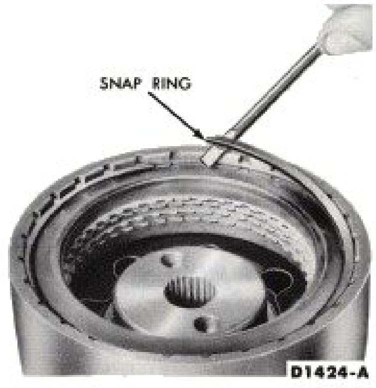


FIG. 70—Forward Clutch Pressure Plate Snap Ring Removal or Installation

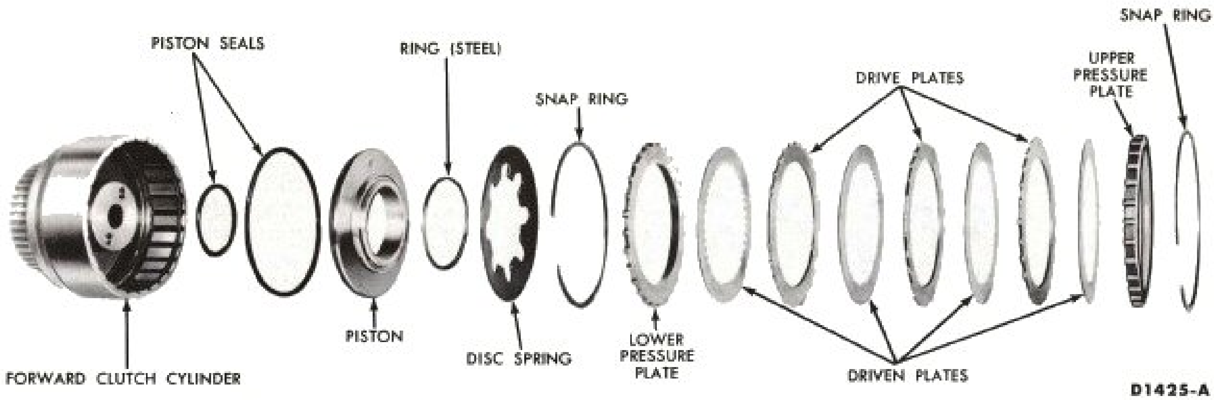


FIG. 71—Forward Clutch Disassembled

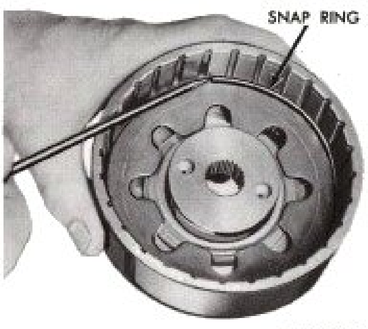


FIG. 72—Disc Spring Snap Ring Removal or Installation

2. Remove the pressure plate, and the drive and driven clutch plates from the clutch hub (Fig. 71).

3. Remove the disc spring retaining snap ring (Fig. 72).

4. Apply air pressure at the clutch piston pressure hole (Fig. 73), to remove the piston from the clutch hub.

5. Remove the clutch piston outer

FIG. 73—Forward Clutch Piston Removal

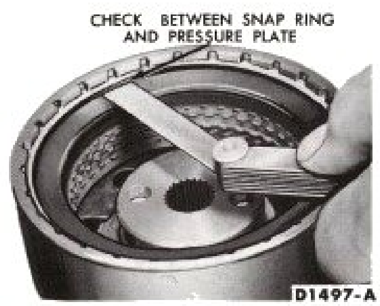


FIG. 74—Checking Forward Clutch Snap Ring Clearance

seal and the inner seal from the clutch hub (Fig. 71).

6. Install new clutch piston seals on the clutch piston and drum. Lubricate the seals with clean transmission oil.

7. Install the clutch piston into the clutch hub. Install the disc spring and retaining snap ring (Fig. 72).

8. Install the lower pressure plate with the flat side up and radius side downward.

Install one non-metallic clutch plate and alternately install the drive and driven plates. The last plate installed will be the top pressure plate with the internal chamfered side up. (Fig. 71). Refer to Part 7-4 for the correct number of clutch plates for the applicable model transmission.

9. Install the pressure plate retaining snap ring (Fig. 70). Make sure the snap ring is fully seated in the ring groove of the clutch hub.

10. With a feeler gauge, check the clearance between the snap ring and the pressure plate (Fig. 74). Downward pressure on the plate should be used when making this check. The clearance should be 0.022 to 0.042 inches.

11. If the clearance is not within specifications, selective snap rings are available in these thicknesses, 0.088-0.092, 0.074-0.078, and 0.060-0.064. Insert the correct size snap ring and recheck the clearance.

FORWARD CLUTCH HUB AND RING GEAR

1. Remove the forward clutch hub retaining snap ring (Fig. 75).

2. Remove the forward clutch hub from the ring gear.

3. Install the forward clutch hub in the ring gear. Make sure the hub

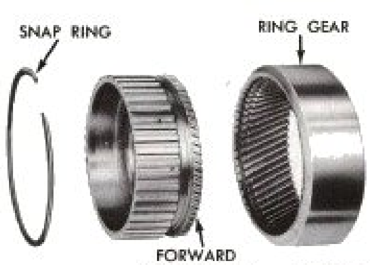


FIG. 75—Forward Clutch Hub and Ring Gear Disassembled

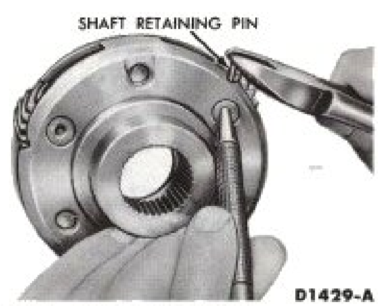


FIG. 76—Pinion Shaft Lock Pin Removal

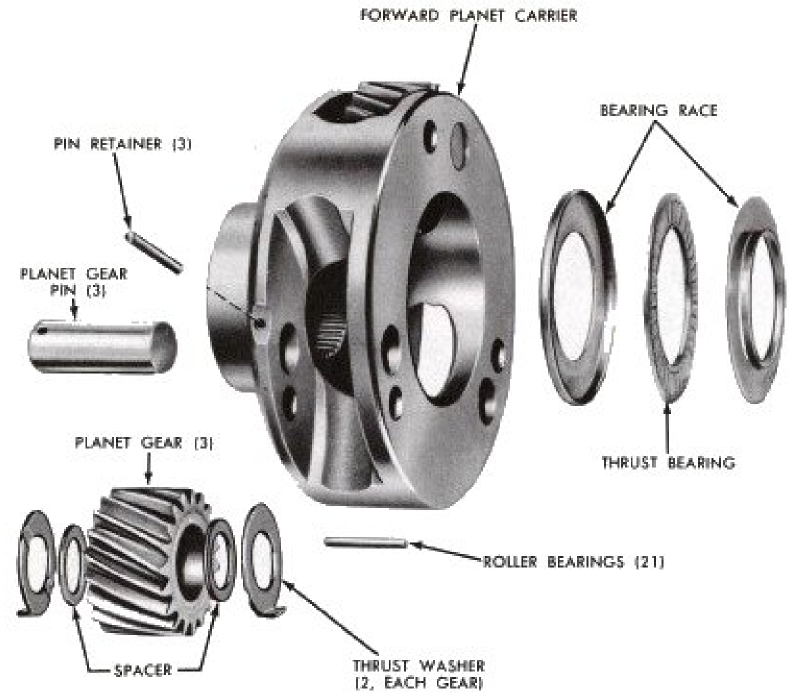


FIG. 77—Forward Planet Carrier

is bottomed in the groove of the ring gear.

4. Install the front clutch hub retaining snap ring. Make sure the snap ring is fully seated in the snap ring groove of the ring gear.

FORWARD PLANET CARRIER

1. Using a small punch inserted into the end of the planet gear retaining pin hole (Fig. 76), force the shaft retaining pins outward. With a pair of side cutters remove the retaining pins.

2. Remove the three planet gear pins (Fig. 77).

3. Remove the three planet gears and thrust washers (Fig. 77).

4. Remove the outer race, thrust bearing, and the inner race (Fig. 77).

5. Install the inner race, thrust bearing, and outer race (Fig. 77).

6. Install 21 roller bearings in each planet gear. Retain the roller bearings in each gear with Vaseline. Position the planet gears and thrust washers in the carrier.

7. Install the gear pins and line up the retaining pin holes in the pin with the retaining pin holes of the carrier. Install the retaining pins in the carrier and shafts.

8. When only the thrust bearing and races have to be removed, remove only two of the planet gear pins. Move the gears outward far enough to allow removal of the thrust bearing and races. This will keep the planet gear roller bearings in position. Reassemble the thrust bearing and races, two gears, and pins.

INPUT SHELL AND SUN GEAR

1. Remove the external snap ring from the sun gear (Fig. 78).

2. Remove thrust washer No. 5 from the input shell and sun gear (Fig. 79).

3. From inside the input shell, remove the sun gear. Remove the internal snap ring from the sun gear.

4. Install the internal snap ring on the sun gear. Install the sun gear in the input shell.

5. Install thrust washer No. 5 on the sun gear and input shell (Fig. 79).

6. Install the external snap ring on the sun gear (Fig. 78).

REVERSE RING GEAR AND HUB

1. Remove the hub retaining snap ring from the reverse ring gear.

2. Remove the hub from the reverse ring gear (Fig. 80).

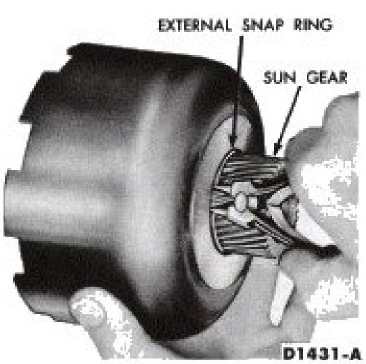


FIG. 78—Sun Gear External Snap Ring Removal or Installation

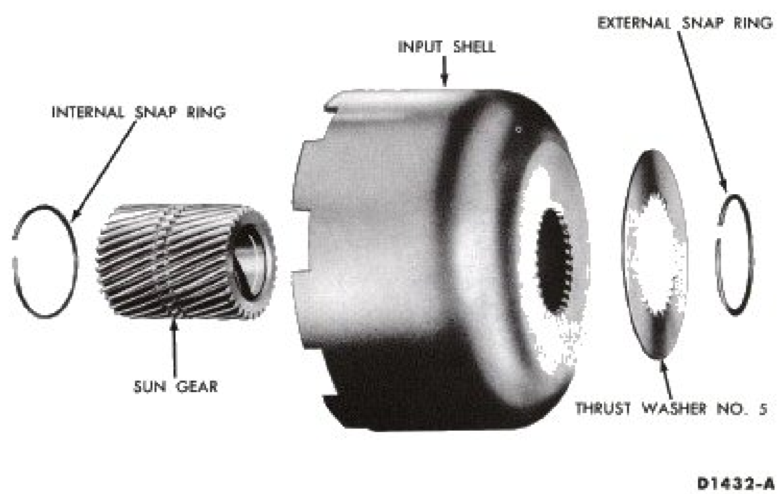


FIG. 79—Input Shell and Sun Gear Disassembled

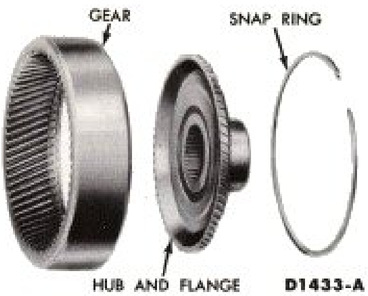


FIG. 80—Reverse Ring Gear and Hub Disassembled

3. Install the hub in the reverse ring gear. Make sure the hub is fully seated in the groove of the ring gear.

4. Install the snap ring in the reverse ring gear. Make sure the snap ring is fully seated in the snap ring groove of the ring gear.

GOVERNOR

1. Remove the three oil rings from the governor distributor (Fig. 81).

2. Remove the two primary governor to distributor retaining bolts. Remove the primary governor housing from the governor distributor (Fig. 81).

3. Remove the primary governor valve retaining lock ring (Fig. 82).

4. Remove the primary governor valve from the housing. Check the free travel of the valve in the housing.

5. Remove the two secondary governor housing to distributor retaining bolts. Remove the secondary governor housing from the governor distributor (Fig. 81).

6. Compress the secondary governor valve return spring and remove the spring retainer (Fig. 83).

7. Remove the secondary governor valve and spring (Fig. 81). Check the free travel of the valve in the housing.

8. Install the secondary governor valve and spring in the governor housing. Compress the spring and install the spring retainer.

9. Place the primary governor valve in the housing and install the lock ring (Fig. 82).

10. Position the primary and secondary governor assemblies on the governor distributor (Fig. 81). Install the retaining bolts. Torque the bolts to specification. **Do not overtorque the bolts.**

11. Install the three oil rings on the governor distributor (Fig. 81).

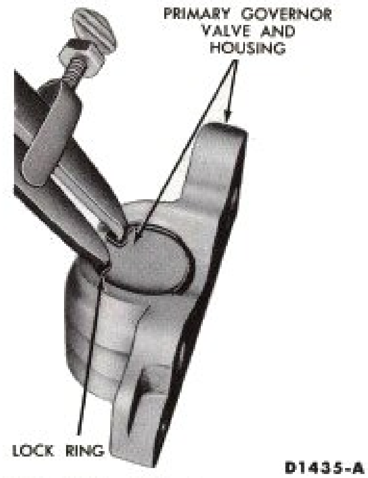


FIG. 82—Primary Governor Lock Ring Removal or Installation

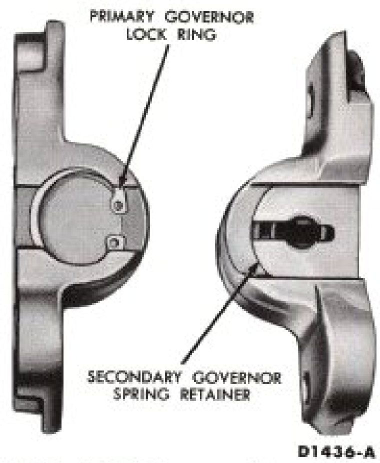


FIG. 83—Primary and Secondary Governor Valves Assembled

ASSEMBLY

When assembling the transmission sub-assemblies (Fig. 84), make sure that the correct thrust washer is used between certain sub-assemblies. Vaseline should be used to hold the thrust washers in their proper location. Lubricate thrust washers, bushings and journal with automatic transmission fluid. If the

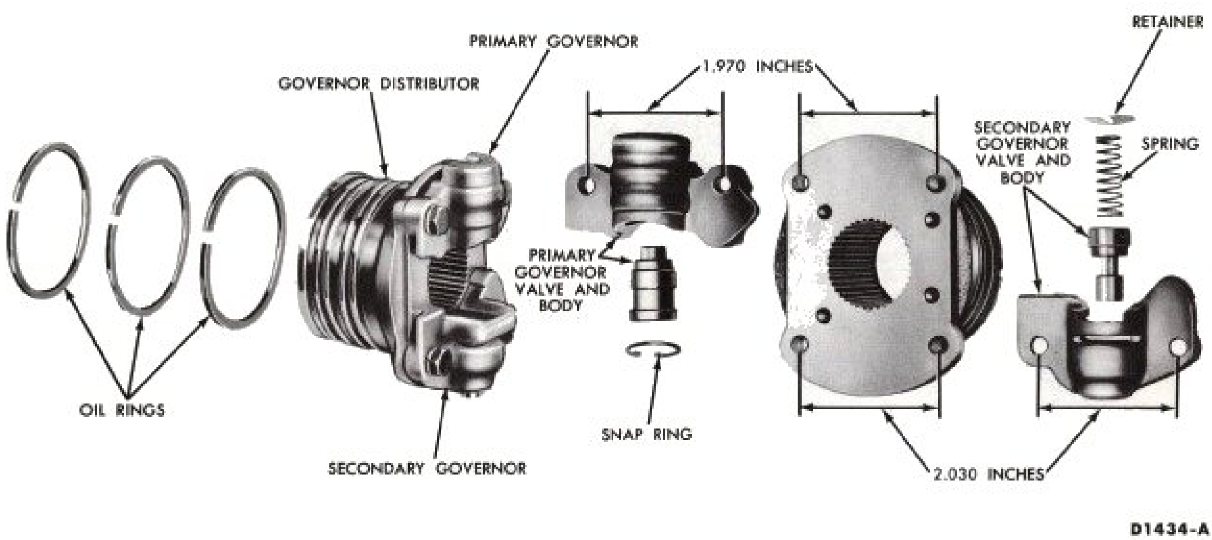
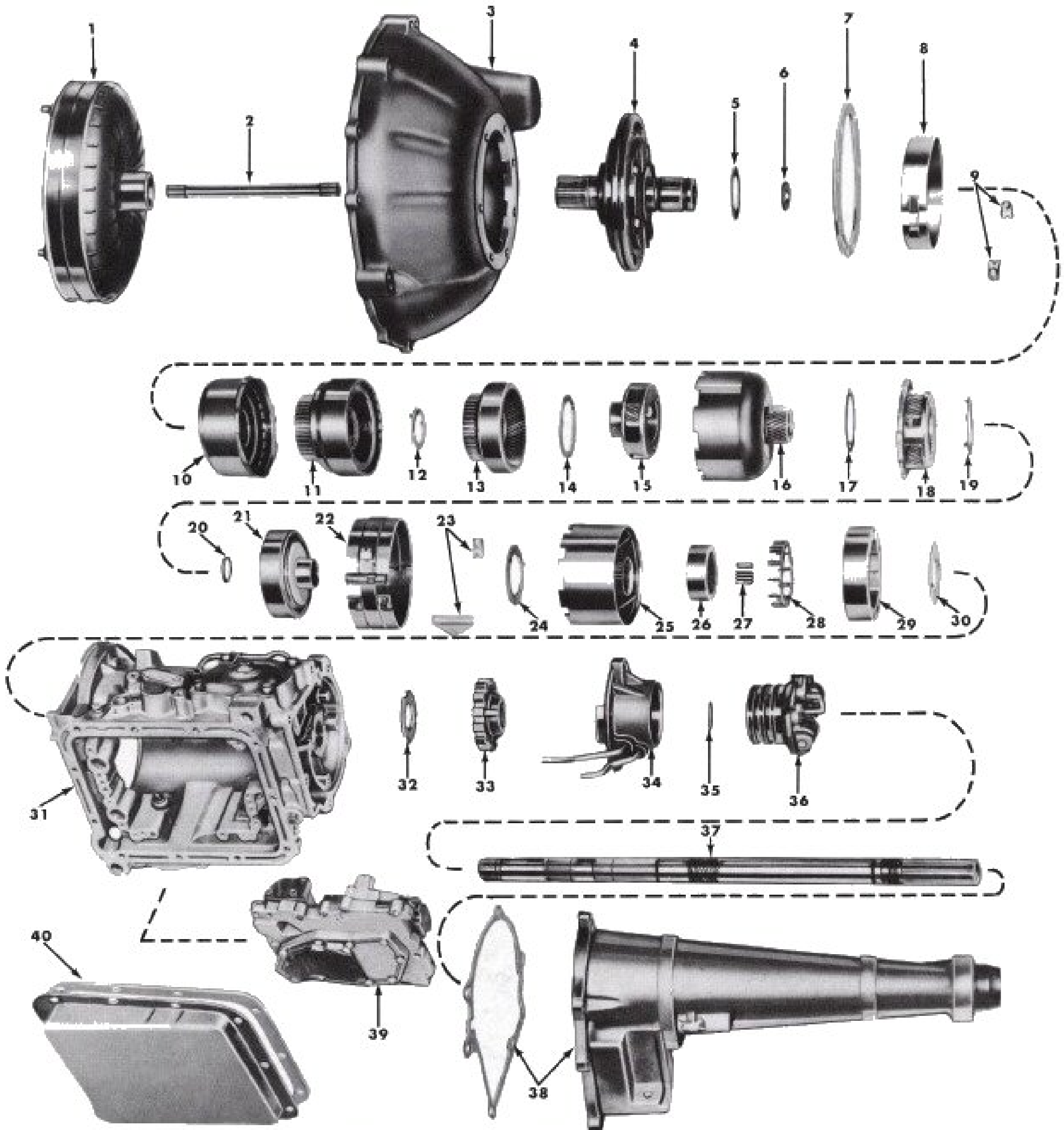


FIG. 81—Governor and Distributor



1. CONVERTER
2. INPUT SHAFT
3. CONVERTER HOUSING
4. FRONT PUMP
5. THRUST WASHER NO. 1
6. THRUST WASHER NO. 2
7. FRONT PUMP GASKET
8. INTERMEDIATE BAND
9. BAND STRUTS
10. REVERSE AND HIGH CLUTCH DRUM
11. FORWARD CLUTCH AND CYLINDER
12. THRUST WASHER NO. 3
13. FORWARD CLUTCH HUB AND RING GEAR
14. THRUST WASHER NO. 4
15. FRONT PLANET CARRIER
16. INPUT SHELL, SUN GEAR AND THRUST WASHER NO. 5
17. THRUST WASHER NO. 6
18. REVERSE PLANET CARRIER
19. THRUST WASHER NO. 7
20. SNAP RING
21. REVERSE RING GEAR AND HUB
22. LOW AND REVERSE BAND
23. BAND STRUTS
24. THRUST WASHER NO. 8
25. LOW AND REVERSE DRUM
26. ONE-WAY CLUTCH INNER RACE
27. ROLLER (12) AND SPRING (12)
28. SPRING AND ROLLER CAGE
29. ONE-WAY CLUTCH OUTER RACE
30. THRUST WASHER NO. 9
31. CASE
32. THRUST WASHER NO. 10
33. PARKING GEAR
34. GOVERNOR DISTRIBUTOR SLEEVE
35. SNAP RING
36. GOVERNOR VALVES & DISTRIBUTOR
37. OUTPUT SHAFT
38. EXTENSION HOUSING AND GASKET
39. CONTROL VALVE BODY
40. OIL PAN AND GASKET

D1378-A

FIG. 84—Transmission Sub-Assemblies

end play is not within specfications, after the transmission is assembled, either the wrong selective thrust washers were used, or a thrust washer came out of position during the transmission assembly operation.

1. Install thrust washer No. 9 inside the transmission case (Fig. 85).

2. Place the one-way clutch outer race inside the case. From the back of the case install the six outer race to case retaining bolts. **Torque the bolts to specification with the tools shown in Fig. 86.**

3. Place the transmission case in a vertical position with the back face of the case upward. Install the parking pawl retaining pin in the case (Fig. 87).

4. Install the parking pawl on the case retaining pin. Install the parking pawl return spring as shown in Fig. 87.

5. Install thrust washer No. 10 on the parking pawl gear (Fig. 88). Place the gear and thrust washer on the back face of the case. (Fig. 87).

6. Place the two oil distributor tubes in the governor distributor sleeve. Install the distributor sleeve on the case. As the distributor sleeve is installed, the oil tubes have to be inserted in the two holes in the case and the parking pawl retaining pin has to be inserted in the alignment hole in the distributor sleeve.

7. Install the four governor distributor sleeve to case retaining bolts and torque the bolts to specification.

8. Install the governor distributor assembly on the output shaft. Install the distributor retaining snap ring (Fig. 43).

9. Check the oil rings in the governor distributor, making sure the oil rings are fully inserted in the ring grooves and will rotate freely. Install the output shaft and governor distributor assembly in the distributor sleeve (Fig. 42).

10. Place a new extension housing gasket on the case. Install the extension housing, vacuum tube clip, and the extension housing to case retaining bolts. Torque the bolts to specification.

11. Place the transmission in the holding fixture with the front pump mounting face of the case up. **Make sure thrust washer No. 9 is still located at the bottom of the transmission case. (Fig. 85).**

12. On the bench, install the 12 one-way clutch springs on the spring retainer (Fig. 89).

13. Place the one-way clutch spring retainer, with the 12 springs installed, into the outer race located inside the transmission case (Fig. 89).

14. Check the position of each spring on the spring retainer. Make sure the springs are properly positioned. Install the inner race inside the spring retainer and 12 springs.

15. Starting at the back of the one-way clutch outer race, install the 12 clutch rollers (Fig. 89). **Each spring will have to be partially compressed as the roller is installed between the outer and inner race (Fig. 89).**

16. After the one-way clutch has been assembled rotate the inner race clockwise to center the rollers and springs. Install the low and reverse drum (Fig. 84). The splines of the drum have to engage with the splines of the one-way clutch inner race, and the bushing in the drum must go on the outer race. Check the one-way clutch operation by rotating the low and reverse drum. The drum should rotate clockwise but should not rotate counterclockwise.

17. Install thrust washer No. 8 on top of the low and reverse drum (Fig. 90). Install the low-reverse band in the case, with the end of the band for the small strut toward the low-reverse servo (Fig. 41).

18. Install the reverse ring gear and hub on the output shaft (Fig. 84).

19. Move the output shaft forward and install the reverse ring gear hub to output shaft retaining ring (Fig. 40).

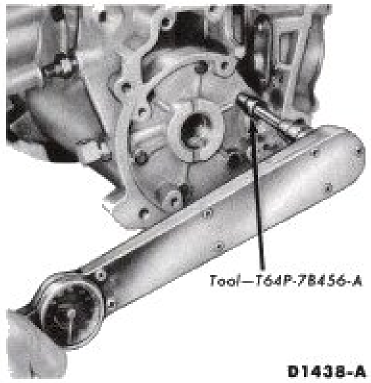


FIG. 86—One-way Clutch Outer Race Retaining Bolt Installation

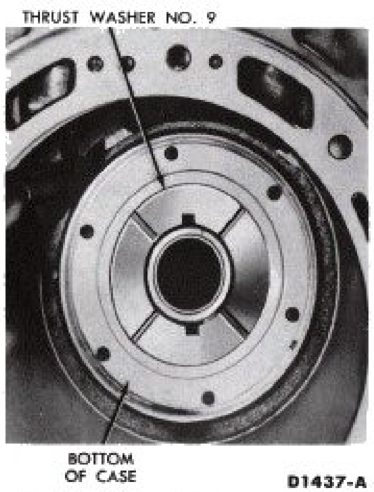


FIG. 85—Thrust Washer No. 9 Location

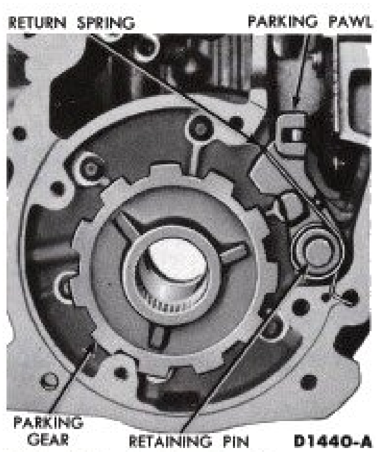


FIG. 87—Parking Pawl and Gear

FIG. 88—Thrust Washer No. 10 Location

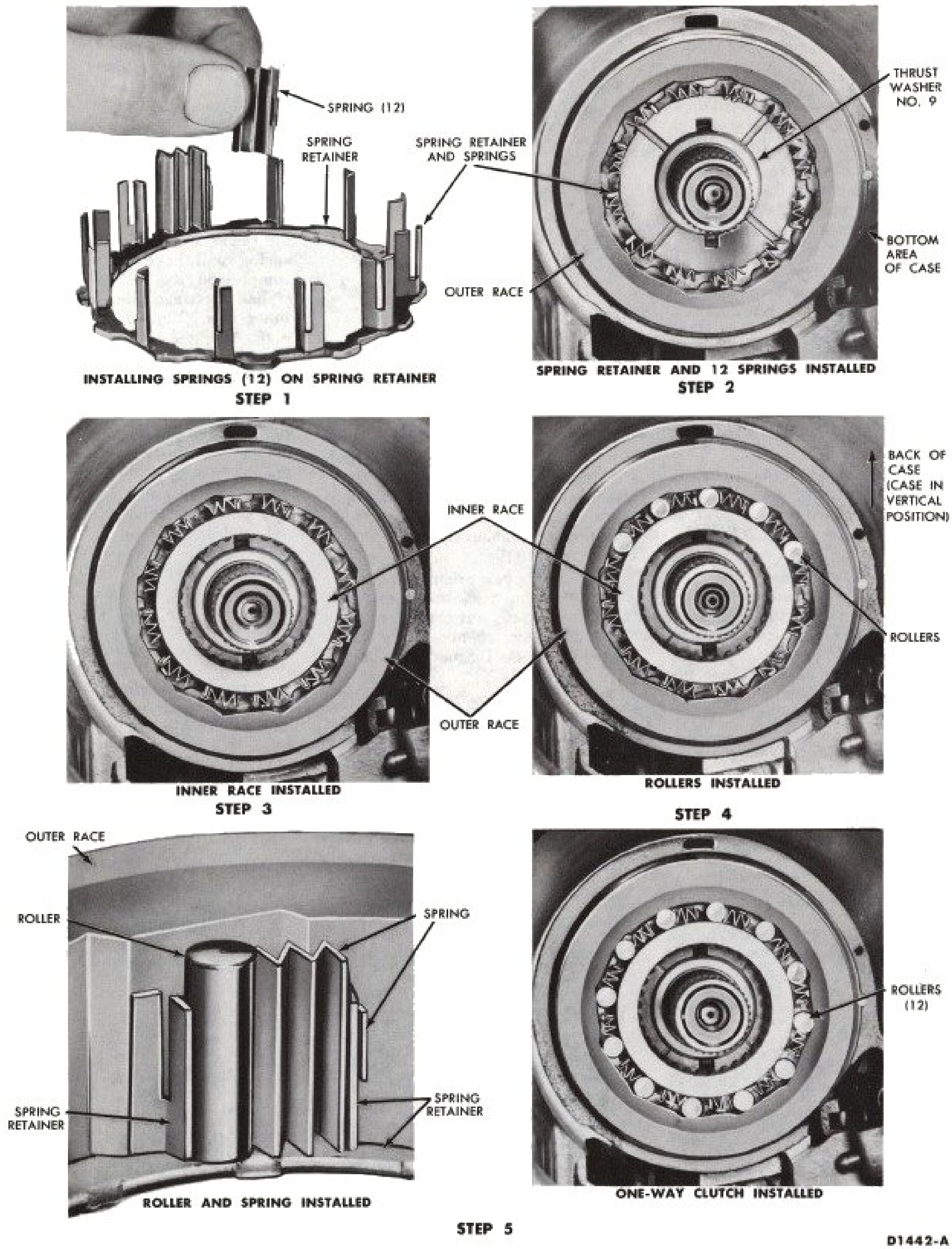


FIG. 89—One-Way Clutch Installation

20. Place thrust washer Nos. 6 and 7 on the reverse planet carrier (Fig. 91). Install the planet carrier in the reverse ring gear and engage the tabs of the carrier with the slots in the low-reverse drum.

21. From inside the transmission case, install the inner downshift lever (Fig. 35).

22. Install the forward clutch in the reverse-high clutch by rotating the units to mesh the reverse-high clutch plates with the splines of the forward clutch (Fig. 92).

23. Install thrust washer No. 3 on the forward clutch (Fig. 93).

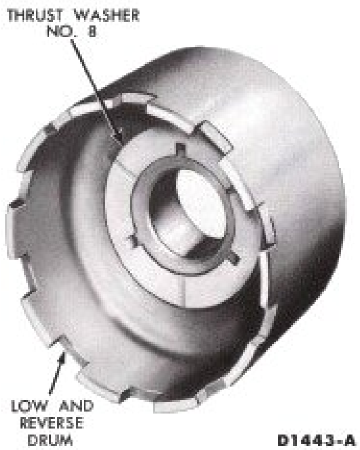


FIG. 90—Thrust Washer No. 8 Location

24. Install the forward clutch hub and ring gear in the forward clutch by rotating the units to mesh the forward clutch plates with the splines on the forward clutch hub (Fig. 94).

25. Install thrust washer No. 4 on the front planet carrier (Fig. 95). Install the front planet carrier into the forward clutch hub and ring gear (Fig. 96). **Check the forward thrust bearing race inside the planet carrier for proper location against the thrust bearing. Make sure the race is centered for alignment with the sun gear on the input shell.**

FIG. 92—Installing Clutch Units

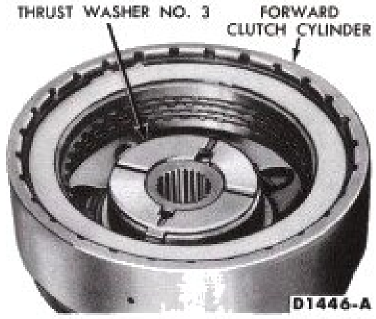


FIG. 93—Thrust Washer No. 3 Location

26. Install the input shell and sun gear on the gear train (Fig. 97). Rotate the input shell to engage the drive lugs of the reverse-high clutch. If the drive lugs will not engage, the outer race inside the forward planet carrier is not centered to engage the end of the sun gear inside the input shell. Center the thrust bearing race and install the input shell.

27. Hold the gear train together and install the forward part of the gear train assembly in the case (Fig. 36). The input shell sun gear must mesh with the reverse pinion gears. The front planet carrier internal splines must mesh with the splines on the output shaft.

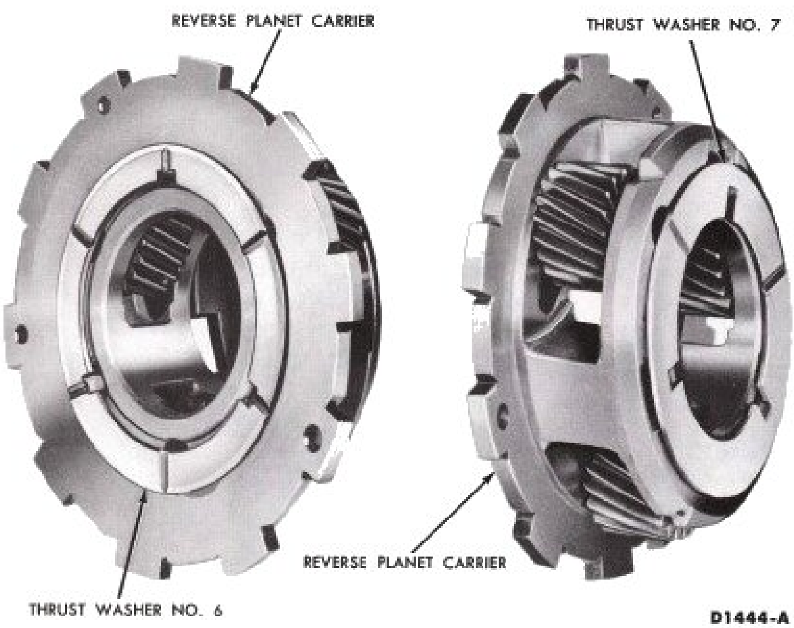


FIG. 91—Thrust Washer No. 6 and 7 Location

FIG. 94—Forward Clutch Hub and Ring Gear Installation

FIG. 95—Thrust Washer No. 4 Location

28. Install the intermediate band through the front of the case (Fig. 34). The side of the band with the anchor points has to be positioned toward the back of the transmission.

29. Install a new front pump gasket on the case. Line up the bolt clearance holes in the gasket with the holes in the case. Using the end play check readings that were obtained during the transmission disassembly procedure, install the correct selective thrust washers Nos. 1 and 2 (Fig. 31) on the front pump stator support. **Use enough vaseline to hold the thrust washers in position during the front pump installation operation.**

FIG. 96—Front Planet Carrier Installation

30. Lubricate the front pump O-ring seal with clean transmission fluid. Install the front pump stator support into the reverse-high clutch. Align the pump to case retaining bolt holes. Install two front pump to case retaining bolts 180° apart. Tighten the bolts until the front pump is properly seated in the case. Remove the two front pump retaining bolts.

31. Install the converter housing on the front pump and case. Install the six converter housing to case retaining bolts. Torque the bolts to specification.

32. Install the input shaft (Fig. 32). Rotate the holding fixture to place the transmission in a horizontal position. Check the transmission end play as shown in Fig. 30. If the end play is not within specification, either the wrong selective thrust washers (Fig. 31) were used or one of the ten thrust washers (Fig. 84) is not properly positioned.

33. Remove the dial indicator used for checking the end play and install the one converter housing to case retaining bolt. Torque the bolt to specification.

34. Install the intermediate and low-reverse band adjusting screws in the case. Install the struts for each band (Fig. 29).

35. Adjust the intermediate and low-reverse band. Refer to In-Car Adjustments and Repair for band adjusting procedures.

36. Install a universal joint yoke on the output shaft. Rotate the input and output shafts in both directions to check for free rotation of the gear train.

37. Install the control valve body (Fig. 28). As the valve body is installed engage the manual and downshift valves with the inner control levers. Torque the eight control valve body to case retaining bolts to specification.

38. Place a new oil pan gasket on the case and install the oil pan and 11 oil pan to case retaining bolts. Torque the retaining bolts to specification.

39. Remove the transmission from the holding fixture. Install the two extension housing to case retaining bolts. Torque the bolts to specification.

FIG. 97—Input Shell Installation

40. Install the primary throttle valve in the transmission case (Fig. 26).

41. Install the vacuum unit, gasket, and control rod in the case. Using the tools shown in Fig. 98 torque the vacuum unit to 15-23 ft-lbs.

42. Make sure the input shaft is properly installed in the front pump stator support and gear train. Install the converter in the front pump and the converter housing.

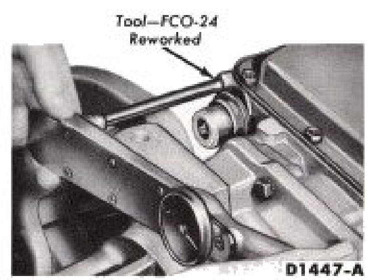


FIG. 98—Vacuum Unit Installation

PART 7-3 FORDOMATIC AND MERCOMATIC SINGLE RANGE TRANSMISSION

1 DESCRIPTION AND OPERATION

DESCRIPTION

The Fordomatic and Mercomatic automatic transmission (Fig. 1) combines a hydraulic torque converter and a planetary gear system.

The planetary gear system is a compound gear set. One clutch and two bands provide two forward speeds and one speed in reverse.

The selector dial has five positions: P (park), R (reverse), N (neutral), D (drive), and L (low).

The selector lever must be at N or P to start the engine. When the selector lever is moved from N or P to D, the transmission shifts from neutral to first gear. At the D position, the car will always start to move in first gear. The shift from first gear to second gear (1-2 shift) will occur automatically between about 15 and 60 mph, depending on intake manifold and vehicle speed.

A forced downshift (kickdown) from second to first can be made at speeds below about 50 mph. On a coast-down, the transmission will automatically shift from second to first at about nine mph. Refer to the specification in Part 7-4 for shift points for each model transmission.

At the L position, the car will start and remain in first gear at all road speeds and at all accelerator positions. Likewise, the transmission will shift into first gear at all road speeds and at all accelerator pedal positions when the selector lever is moved to the L position.

To prevent overspeeding the engine, the transmission should not be shifted into L at speeds higher than the maximum 1-2 automatic shift point for that particular model.

A gate-type stop is provided between the D and L positions to prevent accidental shifts to L. To clear the stop, the shift lever must be lifted toward the steering wheel against spring tension, and then pulled downward.

Accidental shifts to R are prevented by the same type of stop as that used for L. There are no automatic inhibitors for L or R in the transmission. This means that the transmission can be shifted into L or R at any speed. Shifts into reverse **must** be made only after the car has come to a complete stop.

With the selector lever at P, the transmission output shaft is locked to the transmission case by a pawl. With the transmission output shaft locked against rotation, the rear wheels are also locked against rotation.

Figure 1 identifies the transmission that is used. The identification tag shown in Fig. 2 is attached to a rear servo cover bolt. The service identification number shows changes in service details which affect interchangeability when the transmission model is not changed. For interpretation of this number, see the Master Parts Catalog. Table 1 lists the engine and transmission model application by transmission prefix letters.

TABLE 1—Engine and Transmission Application

Engine Model	Transmission Prefix	Car Line
144-1V	PCL-J	Falcon
170-1V	PCM-M	Falcon
260-2V	PCP-J	Falcon Comet
200-1V	PCY-C	Comet-Falcon Station Wagon
200-1V	PCY-D	Comet Car

TORQUE CONVERTER OPERATION

Under all driving conditions, the torque converter transmits the total drive between the engine and the planetary gear set, or between the planetary gear set and the engine. When the engine is driving the rear wheels, the total engine power flows from the converter impeller to the turbine, and then through the planetary gear set to the drive shaft. When the rear wheels are driving the engine, the total rear wheel drive power flows from the drive shaft through the planetary gear set to the converter turbine. The converter turbine transmits this drive to the converter impeller, which is locked to the engine by the flywheel.

The torque converter is a combination hydraulic torque multiplier and fluid coupling (Fig. 4).

PLANETARY GEAR SYSTEM OPERATION

Figure 3 shows a build-up of the planetary gear set. In View 1, note that the engine power always flows from the converter turbine to the primary sun gear. Hence, the primary sun gear always drives, whether the car is driven forward or in reverse.

In View 2, Fig. 3, the integral planet carrier and output shaft has been assembled to the primary sun gear. The long pinions are in constant mesh with the primary sun gear. The long pinions are also in constant mesh with the short pinions. The long pinions will always rotate counterclockwise, and the short pinions will always rotate clockwise.

With only this much of the gear set assembled, no drive from input to output shaft is possible.

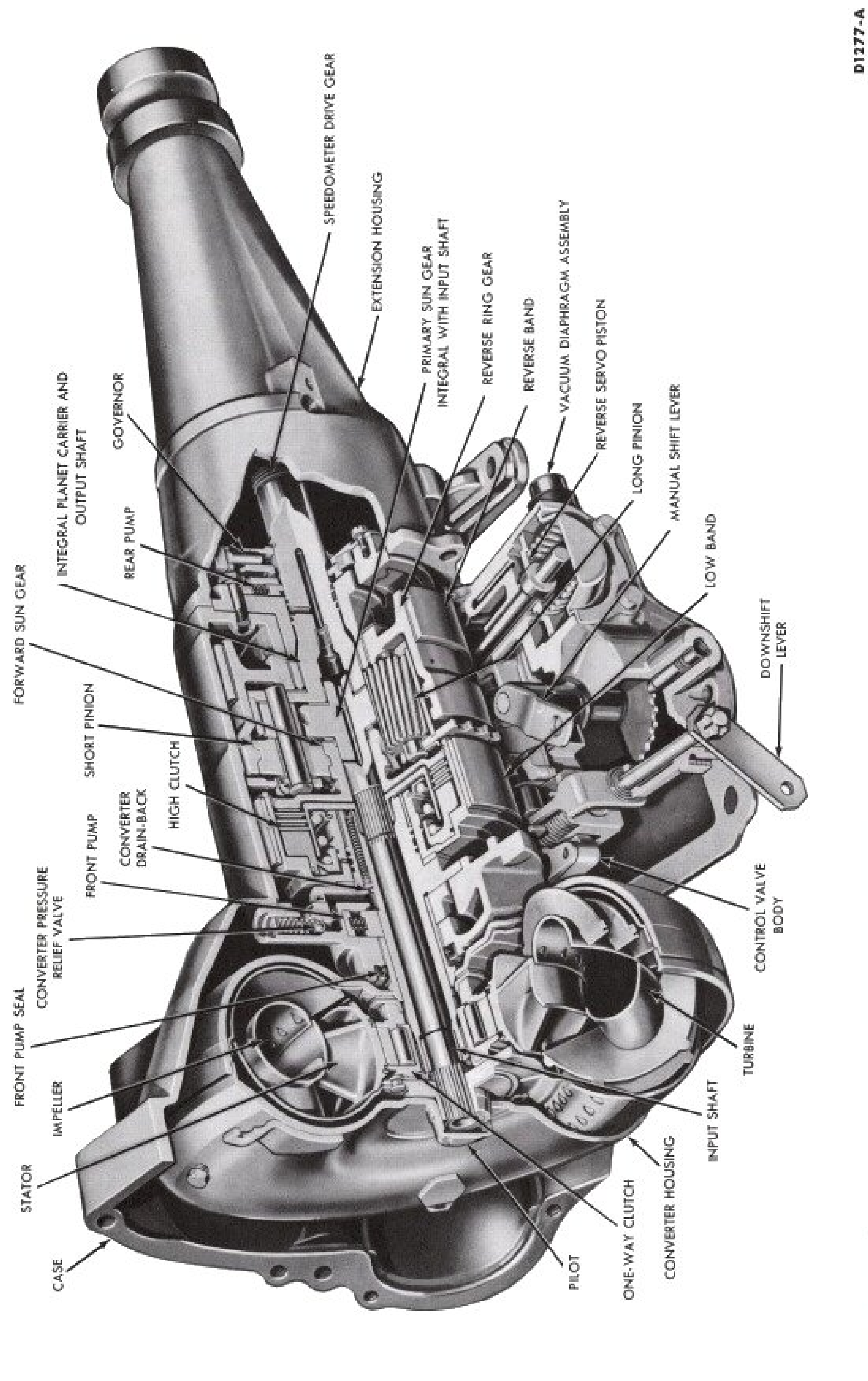


FIG. 1—Fordomatic or Mercomatic Single Range Transmission

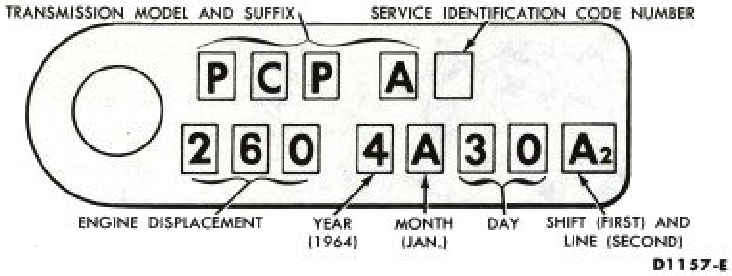


FIG. 2–Transmission Identification Tag

In View 3, Fig. 3, the integral forward sun gear and flange has been added to the gear set. This gear is in constant mesh with the short pinion, and is free-running as far as the integral primary sun gear and shaft is concerned. Attached to the forward sun gear flange is a brake drum. Surrounding the drum is a (brake) band.

If the band is applied so that the drum and forward sun gear are held stationary, the primary sun gear (input) shaft can now drive the output shaft. Engine power drives the primary sun gear clockwise. The primary sun gear drives the long pinion counterclockwise. The long pinion, in turn, drives the short pinion clockwise. The short pinion must now turn on its own center, and at the same time walk around the stationary forward sun gear. As the short pinion and pinion carrier walk around the forward sun gear, the integral planet carrier and output shaft is driven in an input to output ratio of 1.82:1. The planetary gear set is now operating in first (low) gear.

The low band is applied by transmission control pressure working against the low servo piston (Fig. 5).

In View 4, a clutch has been added

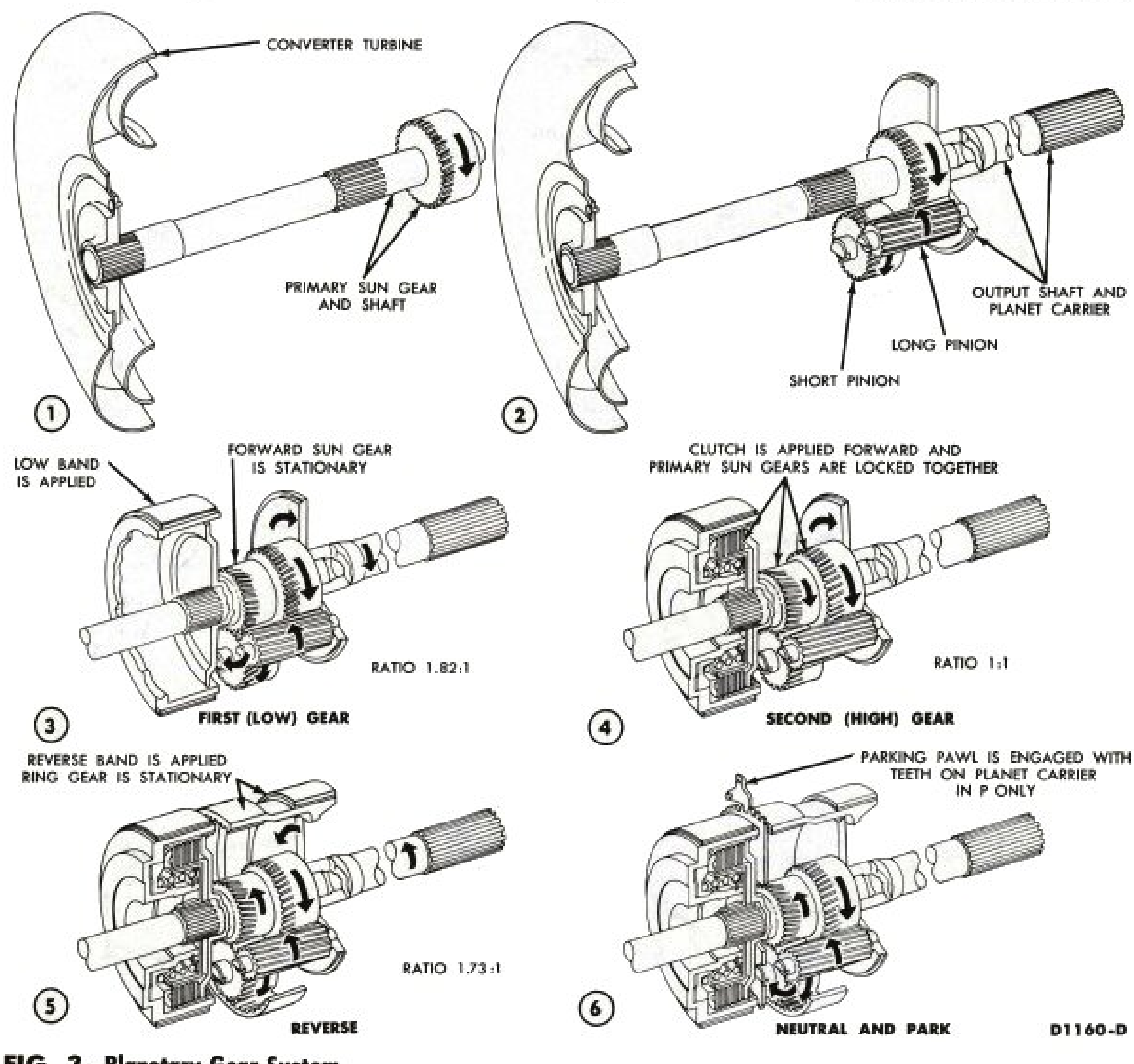


FIG. 3–Planetary Gear System

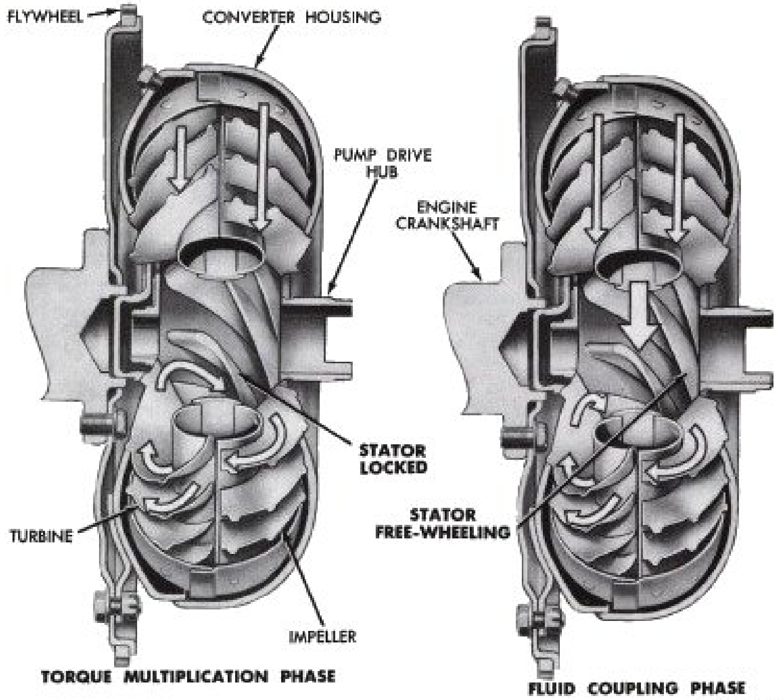


FIG. 4—Torque Converter Operation

to the planetary gear set. The clutch has a different number of plates, depending on the particular model. In any case, the clutch pack is made up of drive and driven plates. The drive plates have internal spline teeth and are splined to the clutch hub. The clutch hub, in turn, is splined to the primary sun gear shaft. The driven plates (steel) have external teeth and are splined to the clutch drum. The clutch drum is splined to the integral forward sun gear and flange.

A piston in the clutch drum is moved by transmission control pressure to lock the clutch plates together. When the clutch plates are locked together, the primary and forward sun gears are locked together. With the two sun gears locked together, all gear action will stop, and the planetary gear set can now revolve only as a unit. With the clutch applied, the transmission is in second (high) gear.

The clutch releases when control pressure behind the piston is exhausted, and the large coil spring forces the piston away from the clutch plate pack.

In View 5, a ring gear and band have been added. The ring gear is in constant mesh with the short pinions. With the low band and high clutch released and the reverse band applied, the transmission output shaft will be driven in a reverse (opposite engine) direction. The reverse band is applied by transmission control pressure working against the reverse servo piston (Fig. 5).

In View 6, a parking pawl has been added. The pawl is anchored to the transmission case. When the pawl engages the teeth on the planet carrier, the output shaft is locked to the transmission case. This prevents the rear wheels from turning.

With the engine running and the car standing still, gear action inside the transmission is identical in the N and P positions.

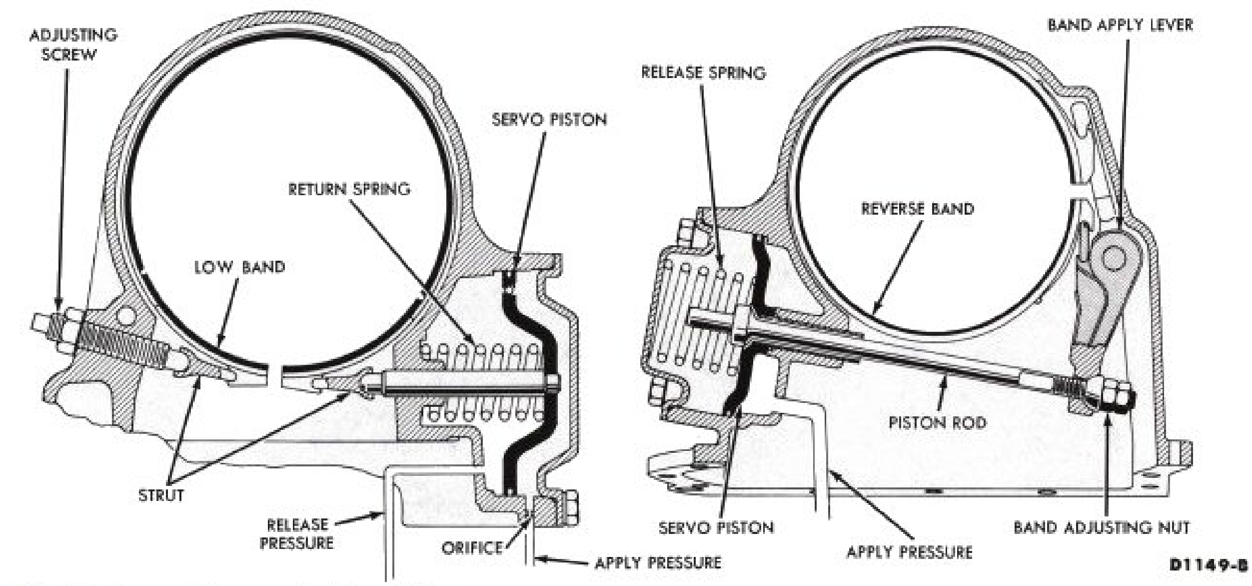


FIG. 5—Low and Reverse Bands and Servos

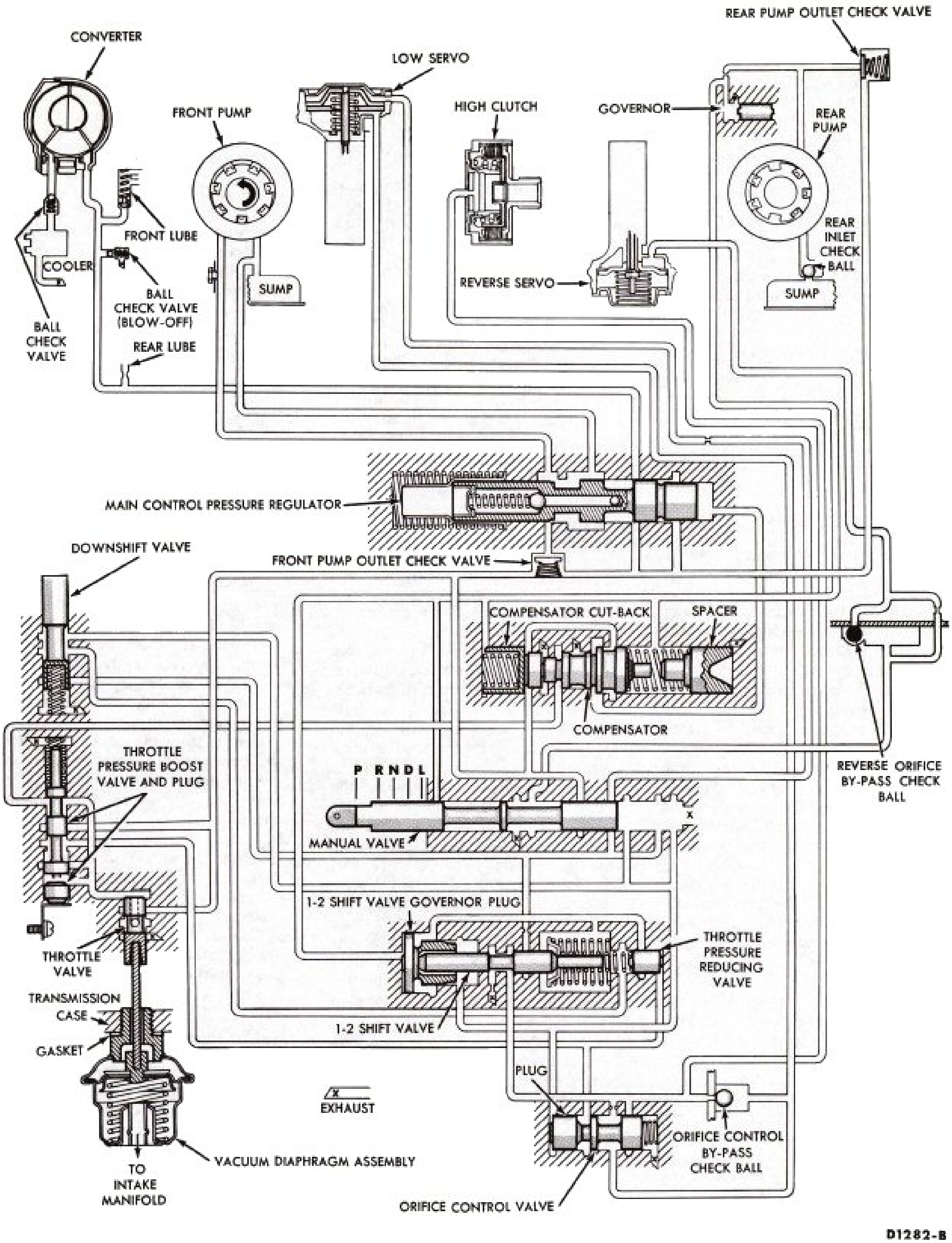


FIG. 6—Hydraulic Control System

HYDRAULIC CONTROL SYSTEM OPERATION

FLUID PRESSURE SOURCE

Two slipper-type pumps deliver fluid pressure to the transmission control system. The front pump, driven by the converter impeller, operates whenever the engine runs (Fig. 6). The rear pump, driven by the transmission output shaft, delivers fluid to the control system, when the vehicle moves forward.

The front pump has a greater capacity than the rear pump, since it must supply all the fluid to operate the transmission at low speeds and in reverse.

Both pumps deliver fluid pressure to the control valve body. A regulated pressure, called control pressure, is available at the control valve body whenever the engine is running.

Check valves are installed on the pressure side of both front and rear pumps.

VACUUM DIAPHRAGM

Engine intake manifold vacuum is high (low pressure) when the engine is idling or operating at light load conditions. The vacuum decreases (high manifold pressure) when the engine throttle is opened and power output increases.

A vacuum diaphragm assembly on the transmission converts the difference in pressure, between intake manifold and atmospheric, into a linear force that will move the throttle valve according to the carburetor throttle opening and engine speed. The diaphragm assembly is basically a cylinder separated into two chambers by a flexible diaphragm. The rear chamber is vented to intake manifold vacuum and contains a spring that exerts a forward pressure on the diaphragm. The forward chamber is vented to atmospheric pressure.

When the engine is idling or operating at light loads the high vacuum (low pressure) on the rear side of the diaphragm allows atmospheric pressure, operating on the front side of the diaphragm, to force the diaphragm toward the rear against spring force. As the engine throttle is opened, the pressure **difference** on the front and rear of the diaphragm becomes **less**, and the spring forces the diaphragm forward. A rod connects the front side of the diaphragm to the transmission throttle valve.

THROTTLE VALVE AND THROTTLE PRESSURE

Line pressure (controlled pump pressure) is available at the throttle valve, located in the upper valve body, when the engine is running. Forward movement of the valve, caused by throttle movement and diaphragm action, allows line pressure to enter a drilled passage and pass to the end of the valve. Throttle valve position depends on the balance between line pressure on the end of the valve and the force exerted in the opposite direction by the vacuum diaphragm rod.

One portion of the TV pressure passes unaffected through the throttle pressure boost valve to the compensator valve thus regulating line pressure; the other portion is directed to the throttle pressure boost valve end and lands, orifice control valve, throttle pressure reducing valve, and the 1-2 shift valve as in previous non-vacuum models.

THROTTLE PRESSURE BOOST VALVE

At large throttle openings intake manifold vacuum changes only slightly with respect to carburetor throttle plate movement. To provide a proper shift pattern in this area of operation, TV pressure must increase at a greater rate than is required at light engine loads. The throttle pressure boost valve in the upper valve body provides the pressure increase.

Line pressure is available at the boost valve when the engine is running. When TV pressure reaches approximately 40 psi its force on the end of the boost valve moves the boost valve to close off TV pressure to the 1-2 shift, governor plug, orifice control valve, and throttle pressure reducing valve and at the same time a passage is opened to allow line pressure to enter the TV circuit to the above valves. Regulation of boosted TV will occur until TV pressure drops to a point where spring force, on the opposite end of the boost valve, returns the valve to its former position.

GOVERNOR PRESSURE

Governor pressure is produced from rear pump pressure by the governor valve. The governor valve operates in the governor body which rotates at output shaft speed. The centrifugal force acting on the governor valve will vary with road speed.

Pressure from the rear pump flows through an orifice into the governor body and tries to move the valve inward against centrifugal force. If the rear pump pressure force is greater than the centrifugal force acting on the governor valve, the valve will be forced inward. As the valve moves inward, it opens an exhaust port and reduces rear pump pressure back to the orifice (Fig. 6).

When the pressure force on the governor valve balances the centrifugal force acting on the governor valve, the governor valve moves out and closes the exhaust.

The pressure in the line past the orifice is regulated by the governor valve and is governor pressure.

Governor pressure is exhausted through the manual valve when manual L is selected.

Rear pump pressure will never be greater than control presure.

CONTROL PRESSURE AND COMPENSATOR PRESSURE

The basic regulation of control pressure is accomplished by the control pressure regulator valve. The valve itself is balanced between spring force on one end, and control pressure force at the other end. Should control pressure force be greater than spring force, the valve will move against the spring and exhaust control pressure, until control pressure force balances spring force.

Control pressure is also adjusted to engine torque, road speed, and selector lever position. To accomplish this, compensator pressure under various conditions is adjusted by throttle pressure (engine torque), governor pressure (road speed), or selector lever position. Compensator pressure, in turn, adjusts control pressure.

Control pressure is assisted, in all driving conditions, by compensator pressure in opposition to the control pressure regulator valve spring (Fig. 6).

An emergency relief valve is built inside the control pressure regulator valve. Should the regulator valve stick, the emergency relief valve will open at approximately 275 psi.

CONVERTER PRESSURE

The front pump (and the rear pump at higher speeds) have a supply capacity far greater than any normal demand in the control pressure system. When control pressure exceeds the required balancing pres-

sure at the control pressure regulator valve, the valve is moved against its spring and opens a port, so that the fluid over and above control pressure requirements can go to the converter. Additional fluid not required by the control or converter circuits is recirculated through the front pump. This flow to the converter is under pressure because in almost every case the supply is ample and there is resistance. The converter check valve will not open and permit flow back to sump until converter-out pressure reaches five psi. After the fluid gets by the check valve, it returns to sump through the cooler. The purpose of the check valve is to prevent the converter upper half from draining back to sump when the engine is stopped. To keep converter pressure from going too high, a relief valve is installed in the converter-in line (actually in the front pump housing). This valve will open when converter-in pressure reaches 70 psi. Fed from the converter-in line are front and rear lubrication systems. To prevent these systems from taking too much fluid from converter-in flow, the lubrication flows are orificed. The front lubrication system has a spring-loaded valve (converter drain-back check valve) to prevent the lubrication system from draining the converter fluid back to sump, when the engine is stopped. A pressure of five psi is required to open this valve.

ORIFICE CONTROL VALVE AND BALL CHECK BYPASS VALVE

The orifice control valve is positioned in a bore in the lower control valve body by a spring. During a normal 2-1 shift with closed throttle, smooth front band application is provided by exhausting the front servo release fluid through an orifice. When the same shift occurs at open throttle, the orifice control valve, positioned by throttle valve pressure, permits an unrestricted exhaust of front servo release pressure, providing a rapid front band application (Fig. 6).

On a manual shift to L while in high gear, control pressure is directed to the orifice control valve to position the orifice control valve for unrestricted exhaust of front servo release fluid.

Since a restricted flow is not desirable for front servo release cavity fill, a ball check is provided in the release cavity circuit. This permits flow to the release cavity to bypass the orifice.

DOWNSHIFT VALVE

The downshift valve (Fig. 6) is positioned in a bore in the upper control valve body. Control pressure is directed to a land of the valve. Linkage is connected between the accelerator pedal and the downshift lever. The downshift valve is moved to momentarily open a passage to direct control pressure to the 1-2 shift valve, and to a face on the governor plug to oppose governor pressure, when the accelerator pedal is depressed through the detent.

N AND P POSITIONS

With the engine running, the front pump is delivering fluid to the control pressure regulator, manual, throttle, compensator, compensator cut-back, throttle boost, and rear pump check valves (Fig. 6).

The manual valve in N or P positions blocks the fluid flow to the clutch and both bands. With no fluid pressure in the clutch or servos, the clutch and both bands are released by spring pressure, and drive through the transmission is impossible.

The front pump is delivering more fluid than is necessary to maintain control pressure; hence, the control pressure regulator valve (assisted by compensator pressure) has moved against its spring, and is delivering fluid to the converter and front and rear lubrication systems.

The converter has been filled and is at normal pressure.

The converter-out check valve has been forced open, and there is a continuous flow of fluid through the converter and back to sump and from the regulator valve to the front pump intake.

D-POSITION–FIRST GEAR

When the manual valve is moved to the D position, control pressure flows to the 1-2 shift valve, downshift valve, and the low servo apply cavity. As soon as the low band applies, the transmission is in first gear (Fig. 6).

When the driver depresses the accelerator pedal, the throttle valve produces throttle pressure which is proportionate to the intake manifold vacuum. Throttle pressure flows through the throttle pressure boost valve to the compensator valve to decrease compensator pressure, and thereby increase control pressure in relationship to the rate the car is being accelerated.

Throttle pressure also flows to the throttle pressure reducing valve. If throttle pressure is more than approximately 20 psi, it will push the valve open, and flow to the spring end of the 1-2 shift valve and to a face on the governor plug. Reduced throttle pressure works with the springs to keep the 1-2 shift valve closed. When the throttle pressure is over approximately 40 psi or the throttle is open approximately 50° or more, the throttle boost valve cuts off throttle and allows boosted TV pressure to enter the throttle pressure circuit.

Throttle pressure can also move the orifice control valve against its spring, so that the low servo release circuit is not restricted. This does not affect the upshift, however, since flow to the low servo release cavity bypasses the orifice control valve.

As the car begins to move, the rear pump pressure builds up with road speed. As soon as there is rear pump pressure there is governor pressure, which increases proportionate to road speed. Governor pressure flows to the compensator valve to increase compensator pressure, and thereby decrease control pressure in relationship to the road speed of the car. Governor pressure also flows to the 1-2 shift valve governor plug to control the timing of the 1-2 shift point.

D-POSITION–HIGH GEAR

The 1-2 shift valve is forced open when governor pressure force exceeds the combined spring and reduced throttle pressure force (Fig. 6). When the 1-2 shift valve opens, control pressure flows through it to release the low band and apply the (high) clutch. When the clutch applies, the transmission is in high (second gear).

Kickdown. When the accelerator pedal is depressed to the floor, control pressure flows through the downshift valve to the spring end of the 1-2 shift valve and a face on the governor plug. Full control pressure working against these areas will close the 1-2 shift valve against governor pressure at speeds below about 50 mph.

When the shift valve closes, it opens an exhaust for the clutch apply and low servo release pressures (Fig.

6). The low band apply pressure, which remained in the apply cavity during high gear operation, now applies the low band. The transmission is now in first (low gear).

On a closed throttle downshift, spring force alone closes the 1-2 shift valve against governor pressure. Since this downshift occurs with zero throttle pressure, the orifice control valve is positioned by its spring. This means that the exhausting fluid from the low servo can flow only through the orifice. A slow exhaust of release pressure means a slow band application.

L-POSITION—FIRST GEAR

The hydraulic control system operation and the planetary gear system operation in D position first gear, and L position first gear, are identical with one exception (Fig. 6). In the L position, an additional control pressure circuit is working. In this circuit control pressure flows from the manual valve against a face of the governor plug, and under the end of the orifice control valve plug. Another branch of the circuit flows through the downshift valve, against the spring end of the 1-2 valve and against a face on the governor plug. Governor pressure in L position is exhausted through the manual valve and can never shift the 1-2 valve. This means that the transmission will go into first gear whenever it is shifted to L, regardless of road speed.

R-POSITION—REVERSE GEAR

When the manual selector lever is moved to R, control pressure flows through the manual valve to the reverse servo and applies the reverse band. Control pressure regulation is the same in R as in L and D except for regulation by governor pressure. Since there is no rear pump pressure in reverse, there is no governor pressure.

The check ball in the reverse circuit, between the manual valve and reverse servo, orifices the apply pressure going to the reverse servo. Control pressure positions the check ball against the hole in the separator plate. The apply pressure then passes through the smaller orifice hole to cause a smooth reverse band engagement. When the manual valve is moved from the reverse detent position, the exhausting reverse servo pressure unseats the check ball, to allow the control pressure to be exhausted unrestricted.

2 IN CAR ADJUSTMENTS AND REPAIRS

MANUAL LINKAGE ADJUSTMENT

1. With the engine stopped, loosen the clamp at the shift lever so that the shift rod is free to slide in the clamp (Fig. 7).
2. Position the selector lever so that the pointer lines up in the D position.
3. Shift the manual lever at the transmission into the D detent position (second from the rear).
4. Tighten the clamp on the shift rod.
5. Check the pointer alignment for all selector lever detent positions.

STARTER NEUTRAL SWITCH ADJUSTMENT

1. Check the starter circuit in all selector lever positions. The circuit must be open in all positions except N and P.
2. To adjust the switch, loosen the neutral switch to steering column attaching screws (Fig. 8). Position the switch so that the starter circuit is closed only when the selector lever is at N and P.

FIG. 7—Manual Linkage

THROTTLE LINKAGE ADJUSTMENT

1. Apply the parking brake, and place the selector lever at N.
2. Run the engine at normal idle speed. If the engine is cold, run the engine at fast idle speed (about 1200 rpm) until it reaches normal operating temperature. When the engine is warm, slow it down to normal idle speed.
3. Connect a tachometer to the engine.
4. Adjust engine idle speed to specification with the transmission selector lever in D.

The carburetor throttle lever must be against the idle adjusting screw at the specified rpm in D.

5. Check and if necessary adjust the dashpot plunger as outlined in Group 8.

6-CYLINDER ENGINES

1. With the engine stopped, adjust the carburetor throttle rod length to obtain an accelerator pedal height of 4¼ inches, measured from either top front corner of the pedal to the floor mat.
2. **Disconnect the throttle return spring and the downshift linkage return spring.**
3. Loosen the adjustment screw on the downshift control rod (Fig. 9).
4. Pull the downshift control rod and the throttle linkage Z bar up to the limit of their travel.
5. Hold them in this position; then slide the adjustment screw down against the Z bar and tighten the adjustment screw.
6. Install the return springs and check the throttle and downshift linkage for full travel.

FIG. 8—Starter Neutral Switch

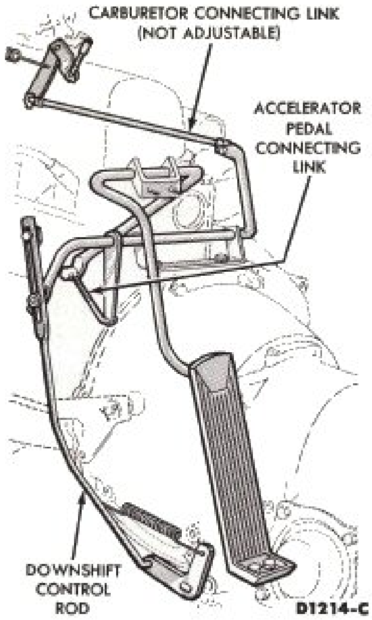


FIG. 9—Throttle Linkage —6 Cylinder Engine

8-CYLINDER ENGINES

1. With the engine stopped, check and, if necessary, adjust the accelerator connecting link (Fig. 10) to obtain an accelerator pedal height of about 4$\frac{5}{16}$ inches, measured from either top front corner of the pedal to the floor mat.

2. With the accelerator pedal at the proper height, and the carburetor lever off the fast idle setting, adjust the carburetor connecting link rod between the carburetor and bellcrank to allow a free fit of the ¼-inch gauge pin through the gauge pin holes of the bellcrank (Fig. 10).

3. The downshift control rod is not adjustable.

LOW BAND ADJUSTMENT

The low band adjusting screw is threaded through the left front side of the case (Fig. 11 and 12).

1. Loosen the locknut several turns.

2. Tighten the adjusting screw with the tool shown in Fig. 11 (Falcon) or Fig. 12 (Comet) until the tool is felt and heard to click. This tool is a pre-set torque wrench which clicks and overruns when torque on the screw reaches 10 ft-lbs.

3. Back off the adjusting screw exactly two turns.

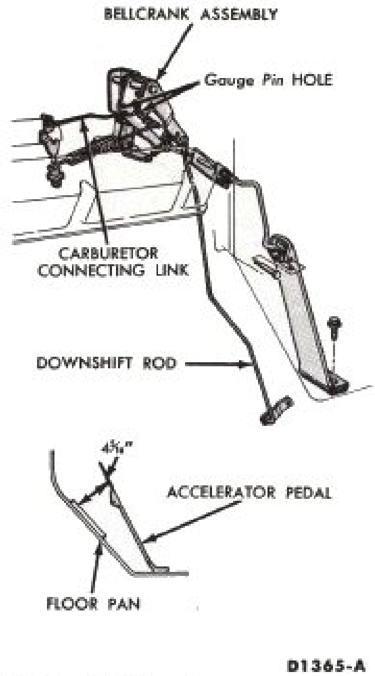


FIG. 10—Throttle Linkage—8 Cylinder Engine

4. Hold the adjusting screw at this position and then torque the locknut to specification.

REVERSE BAND ADJUSTMENT—FALCON

1. Remove the transmission oil pan bolts and loosen the front end of the oil pan carefully to allow the fluid to drain. **If the same fluid is to be used again in the transmission after the band adjustment, filter the fluid through a 100-mesh screen as it drains from the transmission. Reuse the fluid only if it is in good condition.**

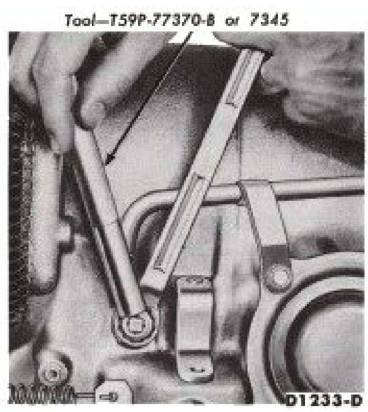


FIG. 11—Low Band Adjustment—Falcon

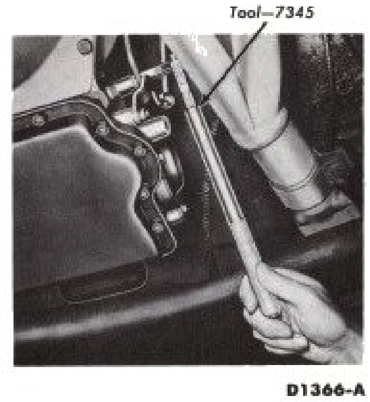


FIG. 12—Low Band Adjustment—Comet

2. Remove and thoroughly clean the oil pan and screen. Discard the oil pan gasket.

3. Loosen the reverse servo piston rod locknut and adjusting nut (Fig. 13).

4. Place the tool on the reverse servo piston rod so that the two forks straddle the band apply lever. The inner fork must engage the flat on the servo piston rod. The outer fork is a ¼-inch spacer and must be inserted between the piston rod seat and the adjusting nut.

5. Back off the piston rod locknut so that the wrench shown in Fig. 13 can engage the adjusting nut. Tighten the adjusting nut until the wrench is felt and heard to click and overrun. This tool is a pre-set torque wrench which clicks and overruns when 45-50 in-lbs torque is applied to the adjusting nut.

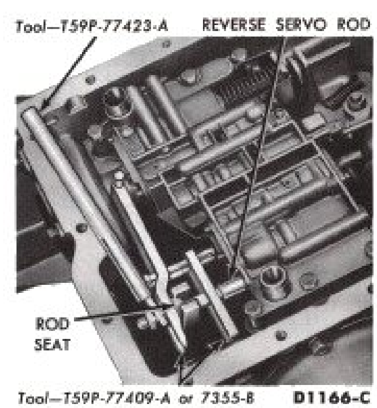


FIG. 13—Reverse Band Adjustment—Falcon

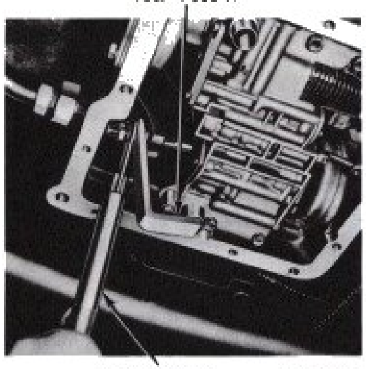


FIG. 14—Reverse Band Adjustment—Comet

6. Back off the adjusting nut exactly 2 turns.

7. Pull the tool (T59P-77409-A) away from the servo rod about one inch. This will permit the adjusting nut to drop into a nut holding slot provided in the tool.

8. Hold the adjusting nut against rotation and torque the locknut to 15-18 ft-lbs.

9. Remove the tool from the servo piston rod.

10. Place a new gasket on the oil pan, and install the screen and pan on the transmission.

11. Fill the transmission.

REVERSE BAND ADJUSTMENT—COMET

1. Drain the transmission. Start at either rear corner of the oil pan and alternately remove the capscrews to lower the corner of the pan. Drain the transmission fluid into a clean drain can equipped with a fine mesh screen.

2. Remove the oil pan and screen from the transmission and clean thoroughly. Discard the oil pan gasket.

3. Loosen the rear servo piston rod locknut and adjusting nut.

4. Insert the reverse band adjusting spacer, Tool 7355-A, between the adjusting nut and the piston rod to actuating lever seat (Fig. 14).

5. Tighten the adjusting nut with tool 7355-B until the tool handle "breaks" over center.

6. Back off the adjusting nut exactly two turns. Hold the adjusting nut stationary and tighten the locknut to specifications.

7. Remove the spacer tool from the servo piston rod.

8. Install the fluid screen and oil pan using a new gasket.

9. Refill the transmission to the "full" mark on the dipstick. Use the fluid drained from the transmission only if it is in good condition. Add new fluid if necessary.

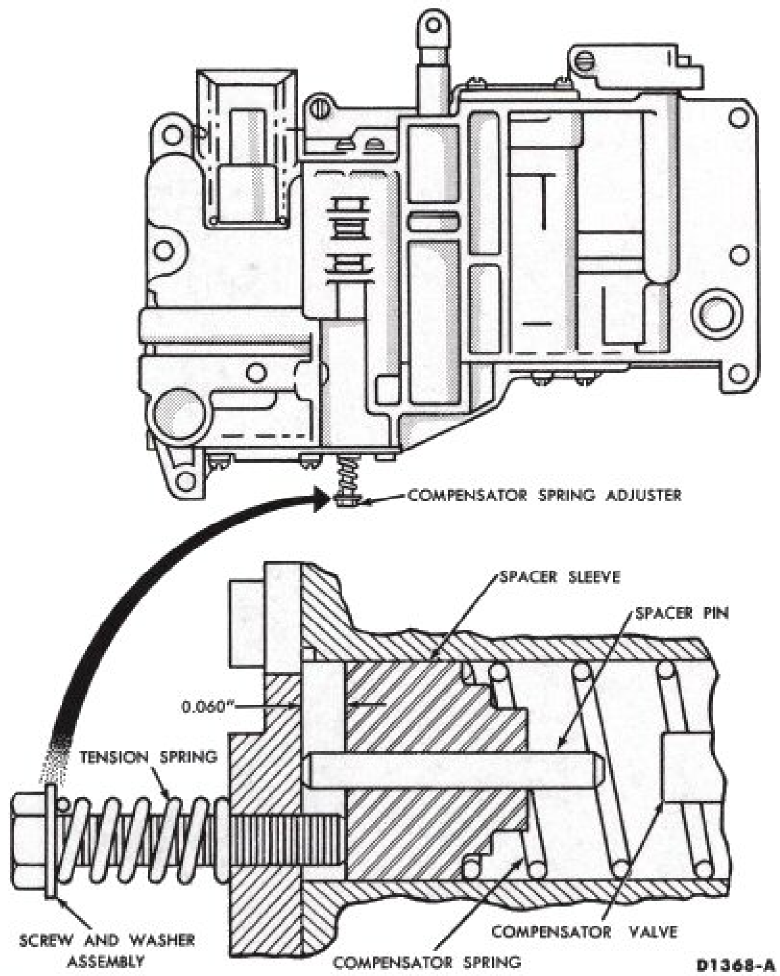


FIG. 15—Compensator Spring Adjustment

VALVE BODY COMPENSATOR SPRING ADJUSTMENT

Due to repair operations it may become necessary to adjust the compensator spring tension (Fig. 15).

To make an initial adjustment of the screw before installing the main control assembly, remove the lower body right front cover plate from the main control valve body and turn the adjusting screw (Fig. 15) until it protrudes through the cover plate approximately 0.060 in. This will require approximately 1½ turns when starting from a flush position.

Use the following procedure if it is necessary to adjust the compensator spring with the valve body in the car.

1. Attach a pressure gauge to the transmission.

2. Attach a vacuum gauge to the vacuum diaphragm line. This is necessary to check for a vacuum leak, causing a false line pressure reading.

3. Start the engine and allow the transmission to reach its normal operating temperature.

4. After the transmission has reached its normal operating temperature, record the idle line pressure. Refer to Specification Section 7-4. If the pressure is not within specifications remove the transmission oil pan.

5. To increase line pressure, turn the adjusting screw counterclockwise. This lowers compensator pressure. To decrease line pressure, turn the adjusting screw clockwise. This in-

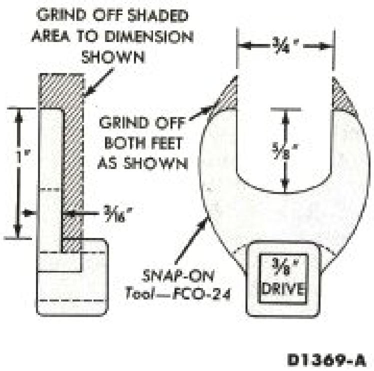


FIG. 16—Reworked Tool FCO-24 To Remove Vacuum Unit

creases compensator pressure. **One (1) complete turn (360°) of the adjusting screw will change the line pressure approximately ten psi.**

6. After the adjustment has been made, install the transmission oil pan gasket and pan. Fill the transmission with oil.

7. Start the engine and move the manual selector lever to all ranges several times before reading the pressure gauge.

8. Recheck the control pressure. If the pressure is correct, remove the gauges.

The control valve body, governor, low servo piston and cover seal, reverse servo cover seal, and extension housing bushing and seal can be removed for servicing without removing the transmission from the car.

CONTROL VALVE BODY REPLACEMENT

1. Raise the car so that the transmission oil pan is accessible.

2. Clean the outside of the oil pan. Remove the transmission oil pan bolts and loosen the front end of the oil pan carefully to allow the fluid to drain. Remove the oil pan and gasket. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Reuse the fluid only if it is in good condition.**

3. Remove the vacuum diaphragm and rod with a reworked FCO-24 tool (Fig. 16).

Do not apply torque to the sheet metal portion of the diaphragm assembly.

4. Remove the fluid screen retaining clip and the screen.

5. Remove the six bolts that attach the control valve body to the transmission case (Fig. 17).

6. Carefully lower the control valve body and work the manual shift link out of the manual valve.

7. When the control valve body is installed in the transmission, make sure that the manual shift link is connected to the manual valve and that the downshift lever is located between the downshift valve and the stop plate on the upper body.

8. Install the six control valve body to case attaching bolts and torque them to specification.

9. Install the screen and screen retainer clip.

10. Install the diaphragm unit and rod, and torque to specifications.

Do not apply torque to the sheet metal portion of the diaphragm assembly.

11. Position a new oil pan gasket on the bottom of the transmission case, and install the oil pan. Torque the oil pan screws to specification.

12. Fill the transmission and adjust the manual and downshift linkage.

GOVERNOR REPLACEMENT

1. Raise the car so that the transmission extension housing is accessible.

2. Clean exterior of oil pan. Remove the transmission oil pan bolts and loosen the front end of the oil pan carefully to allow the fluid to drain. Remove the oil pan and gasket. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Reuse the fluid only if it is in good condition.**

3. Disconnect the drive shaft at the drive pinion flange and remove it.

4. Place a transmission jack under the transmission oil pan and raise the transmission until the extension housing is clear of the cross member.

5. Disconnect the speedometer cable and the parking brake front cable.

6. Remove the engine rear support member from the brackets.

7. Lower the transmission for greater accessibility, and then remove the extension housing to case

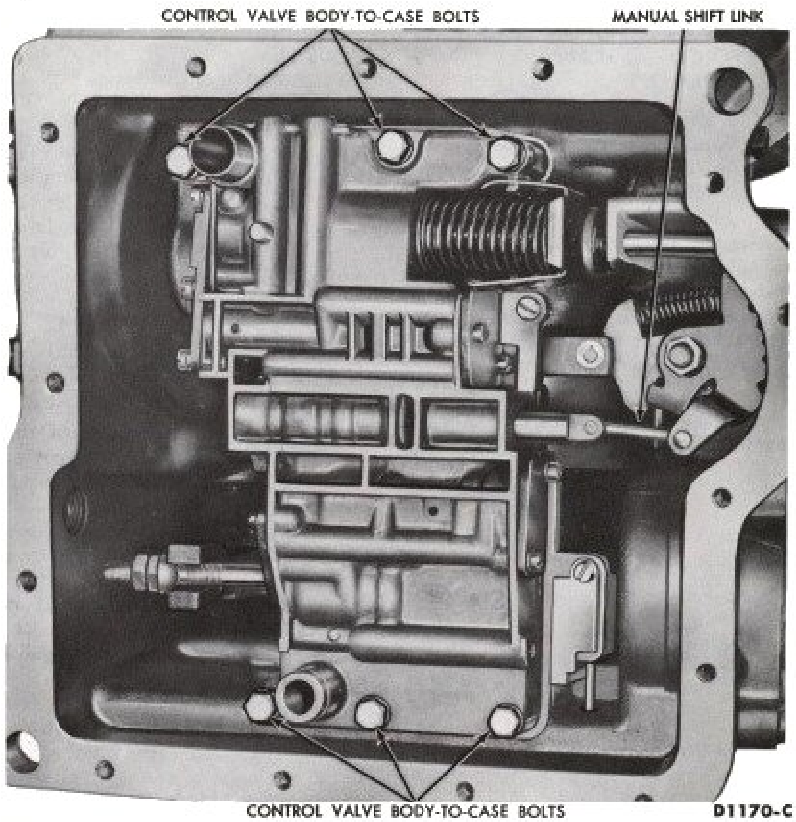


FIG. 17—Control Valve Body Mounted on Transmission Case

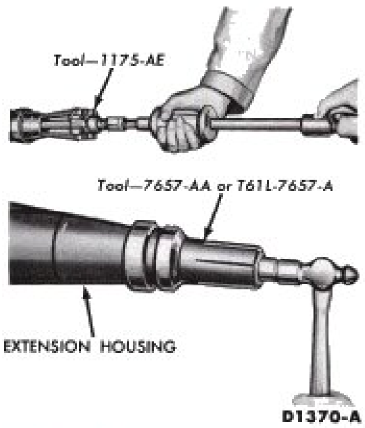


FIG. 18—Removing and Installing Extension Housing Seal

bolts, vacuum tube and vent tube if transmission is so equipped.

8. Remove the extension housing.

9. Remove the governor snap ring, governor and ball.

10. To install the governor, reverse the above procedure, installing a new housing gasket.

LOW SERVO PISTON AND SERVO COVER SEAL REPLACEMENT

1. Thoroughly clean the low servo cover and the portion of the transmission case around the cover. Some fluid will drain from the transmission during removal of the low servo cover and piston. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Reuse the fluid only if it is in good condition.**

2. Remove the lock nut from the low band adjusting screw and loosen the oil fill tube.

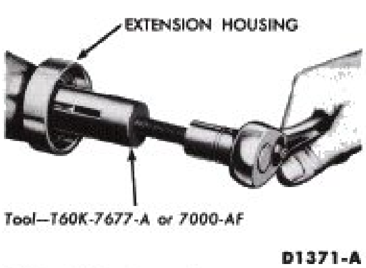


FIG. 19—Removing Extension Housing Bushing

3. Remove the servo cover retaining bolts.

4. As the cover separates from the case, tighten the low band adjusting screw and keep tightening it as the cover (and servo piston) move away from the case. This will cause the strut between the low servo piston stem and the low band to wedge against the case and stay in position when the low servo piston stem moves out of the strut.

5. Remove the cover, low servo piston and spring.

6. Inspect the ball check valve in the low servo piston for free movement and proper seating. If any defect other than foreign material is found in the ball check valve, replace the servo piston.

7. Place a new seal on the servo cover. **Do not twist the seal.**

8. Position the servo spring, servo piston and cover. **The low servo piston ball check valve must be positioned at the top** (Fig. 44). Start the two 1-inch bolts.

9. Carefully pull the cover against the case by tightening the bolts. At the same time, keep loosening the low band adjusting screw as the cover moves closer to the case.

10. Torque the cover bolts to specification.

11. Adjust the low band.

12. Fill the transmission with fluid. **Do not overfill.**

13. Start the engine and, with the transmission at normal operating temperatures, increase the engine rpm slightly. Move the selector lever from N to D about 20 times to bleed any air out of the low servo.

REVERSE SERVO COVER SEAL REPLACEMENT AND/OR PISTON SEAL REPLACEMENT

1. Thoroughly clean the reverse servo cover and the portion of the transmission case around the cover. Draining of fluid from the transmission will occur during removal of the reverse servo cover. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Reuse the fluid only if it is in good condition.**

2. Remove the upper left and lower right reverse servo cover retaining bolts that are 180° apart. Remove the vent tube. Install two 1$\frac{3}{16}$-inch long bolts into the bolt holes. Run the bolts in finger-tight until they bottom.

3. Remove the two remaining short bolts and the identification tag. Remove the two longer bolts by turning each bolt one turn at a time. Remove the servo cover and spring.

4. Install a new seal on the servo cover. **Do not twist the seal.**

5. Remove vacuum control unit and control rod.

6. Loosen oil pan bolts to drain transmission oil. Remove transmission oil pan and screen.

7. Remove control valve body.

8. Remove rear band adjusting nut and jam nut.

9. Slide the piston out of the case far enough to replace the piston seal. Air pressure may be inserted into reverse apply passage to remove piston.

10. Install the piston back in the bore in the case.

11. Install the rear band adjusting nuts and adjust the rear band.

12. Install control valve body and oil screen. Then install the vacuum unit and control rod.

13. Install a new gasket on the oil pan and install the oil pan.

14. Position the reverse servo spring and cover. Start two 1$\frac{3}{16}$-inch long bolts into the upper left and lower right two bolt holes that are 180° apart.

15. Carefully pull the cover against the case by tightening the two long bolts until they bottom finger tight.

16. Start the two short bolts and tighten them carefully. Remove the two long bolts and install the vent tube and the two remaining short bolts. Be sure to place the identification tag under the lower rear cover bolt. Torque the cover bolts to specification.

17. Fill the transmission with fluid. **Do not overfill.**

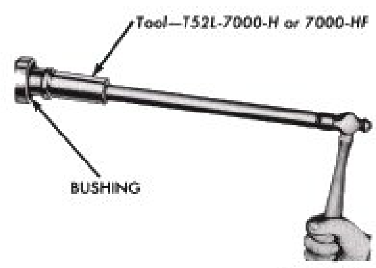


FIG. 20—Installing Extension Housing Bushing

EXTENSION HOUSING BUSHING AND REAR SEAL REPLACEMENT

1. Disconnect the drive shaft from the transmission.
2. Carefully remove the rear seal with tools shown in Fig. 18.
3. Remove the bushing using tool shown in Fig. 19. **Use caution when the bushing remover tool is installed so that the spline seal is not damaged.**
4. When installing a new bushing, use the special tool shown in Fig. 20.
5. Before installing new seal, inspect the sealing surface of the universal joint yoke for scores. If scores are found, replace the yoke.
6. Inspect the counterbore of the housing for burrs. Polish off all burrs with crocus cloth.
7. Drive the seal into the housing with the tool shown in Fig. 18.

3 REMOVAL AND INSTALLATION

REMOVAL

1. Drive the car onto a hoist but do not raise it at this time.
2. From under the hood, remove the starter cable from the starter.
3. Raise the car on a hoist.
4. Drain the transmission fluid.
5. If the transmission oil is water cooled, disconnect the oil cooler lines from the transmission.
6. Disconnect the drive shaft at the rear and remove it. Place a transmission rear seal replacer tool in the rear of the transmission.
7. Remove the manual and downshift linkage from the transmission.
8. Remove the starter.
9. On some models it may be necessary to remove the exhaust pipe from the manifolds and from the muffler inlet pipe.
10. Disconnect the speedometer cable from the extension housing and the vacuum line from the diaphragm. If the transmission is to be overhauled, remove the diaphragm assembly with a modified FCO-24 tool (Fig. 16).
11. Disconnect the oil filler tube from the case.
12. Remove the parking brake front cable from the equalizer bar.
13. Place a transmission jack under the transmission and raise the jack until it is just supporting the transmission.
14. Remove the bolts that retain the rear support to the transmission extension housing and remove the crossmember underbody retaining bolts. Remove the crossmember.
15. Lower the transmission and support the rear of the engine.
16. Remove the converter lower cover and remove the four stud nuts that retain the converter to the flywheel.

Do not attempt to turn the flywheel with a wrench on these nuts. Use a commercial flywheel turning tool.

17. Remove the converter housing to engine block bolts.
18. Secure the transmission to the jack and remove the transmission from the car.

INSTALLATION

1. Secure the converter to the transmission (Fig. 21).
2. Mount the transmission on the jack and position it under the car.
3. Raise the transmission and start the converter housing on the engine block dowel pins.
4. Start two lower converter housing to engine block bolts. **As these two bolts are tightened be sure the converter pilot enters the crankshaft and that the drive lug holes line up with the drive bolt holes in the flywheel.**

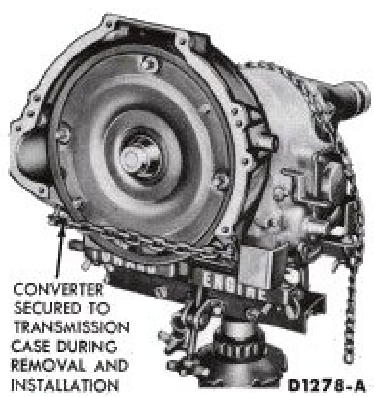


FIG. 21—Transmission Mounted on Jack

Install the remaining converter housing to engine bolts.

5. Install the cross member.
6. Remove the engine support bar or stand and lower the transmission on the engine rear support. Install the support clamp and bolts.
7. Install the three converter drive lug to flywheel bolts (bolt heads go on the engine side of the flywheel). **Do not use washers.**
8. Install the starter seal and starter, and attach the starter cable.
9. Install the converter housing lower cover.
10. Connect the cooler lines, filler tube, and diaphragm tube clamp.
11. Connect the downshift and manual linkage. Lubricate the downshift lower pivot point with ball joint grease.
12. Connect the speedometer cable and the diaphragm tube to the diaphragm. Connect and adjust the parking brake cables.
13. Lubricate the front universal joint yoke with Ford Lubricant B8A-19589-A and install the drive shaft.
14. Lower the car to the floor. Fill the transmission with fluid. Then check the fluid level with the transmission at normal operating temperature.
15. On six-cylinder engine, with the engine running at idle speed, shift the selector lever from N to D and from D back to N at least 20 times. The repeated shifting of the selector lever will fill the low servo release cavity with fluid and expel the trapped air.
16. **Adjust the control linkage.**

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

1. Before removing any of the transmission sub-assemblies, thoroughly clean the outside of the transmission case to prevent dirt from getting inside the mechanism.
2. After the transmission has been removed from the car, remove the converter and place the assembly in

FIG. 22—Transmission Mounted in Holding Fixture

the transmission holder as shown in Fig. 22.

REMOVAL OF OIL PAN AND CONTROL VALVE BODY

1. Remove the oil pan and gasket.
2. Remove the screen retaining clip, and then remove the screen.
3. Remove the vacuum unit and control rod. Remove the six bolts that attach the control valve body to the case (Fig. 17) and remove the valve body.
4. Reverse the above procedure to assemble valve body and oil pan.

TRANSMISSION END PLAY CHECK

1. Mount a dial indicator on the transmission case so that the contact rests on the end of the primary sun gear (turbine) shaft as shown in Fig. 23.
2. Install the extension housing seal replacer or a front universal

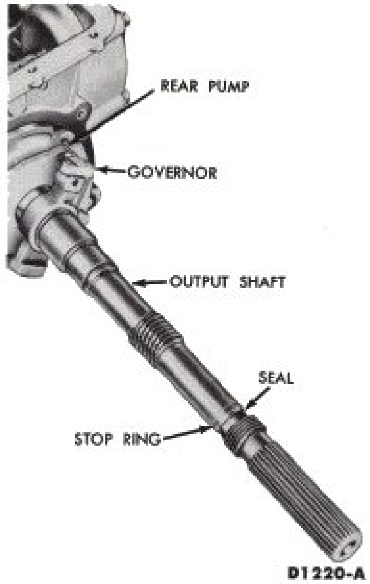


FIG. 24—Output Shaft and Governor

joint yoke on the output shaft spline to align the output shaft.

3. Pry the reverse ring gear (Fig. 23) forward with a large screwdriver. Set the dial indicator at zero while maintaining a slight pressure on the screwdriver.
4. Now pry the clutch drum to the rear (Fig. 23). Record the indicator reading for use during transmission assembly. End play should be between 0.020 and 0.039 inch.

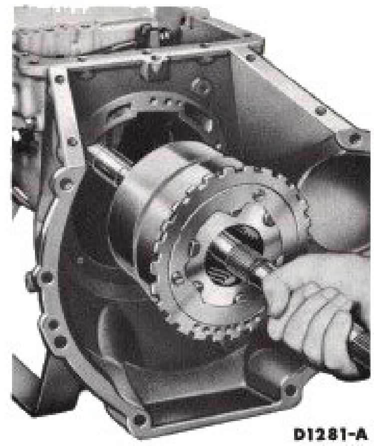


FIG. 25—Output Shaft Removal or Installation

5. Remove the indicator and the seal replacer or yoke.

REMOVAL OF CASE AND EXTENSION HOUSING PARTS

1. If the extension housing seal or bushing is to be replaced, use the tools shown in Fig. 18, 19 or 20.
2. Remove five extension housing to case bolts. Remove the extension housing.
3. Remove the governor snap ring, governor and the governor drive ball (Fig. 24).
4. Remove the bolts that attach the front pump housing to the transmission case. Remove the front pump and stator support assembly.

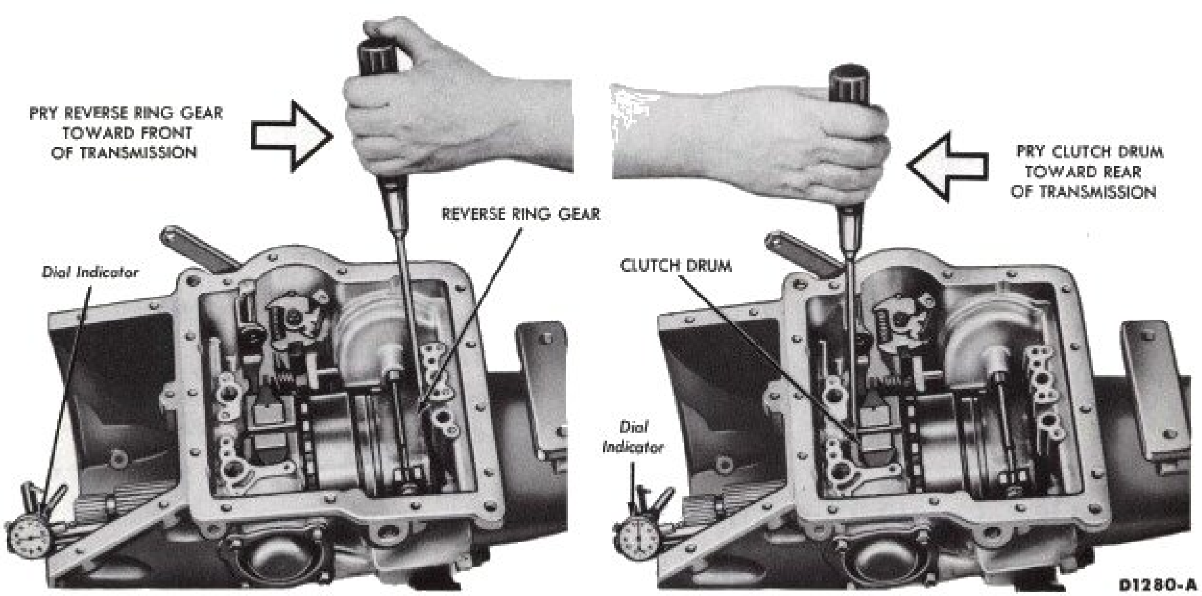


FIG. 23—Transmission End Play Check

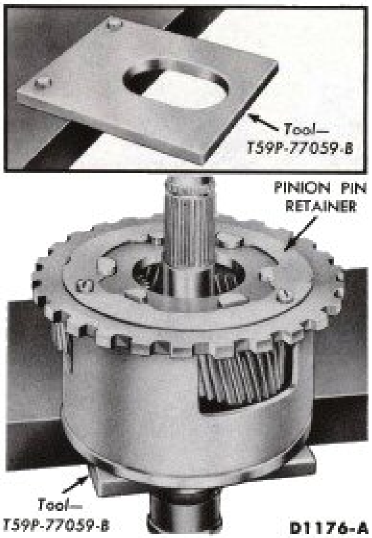


FIG. 26—Output Shaft Mounted in Bench Holding Fixture

5. Loosen the low band adjusting screw. Remove the low band struts. Remove the seal ring from the primary sun gear (turbine) shaft and then remove the clutch drum. Now, remove the low band.

6. Pull on the primary sun gear (turbine) shaft and remove the integral pinion carrier and output shaft, and the reverse ring gear (Fig. 25) from the case.

7. Remove the governor pressure seal rings from the output shaft.

8. Place the integral output shaft and pinion carrier in the bench fixture shown in Fig. 26.

9. Remove the reverse ring gear thrust washer from the case.

10. Remove the four rear pump attaching bolts and remove the rear pump from the case.

11. Remove the reverse band from the case.

PARTS REPAIR OR REPLACEMENT

During the repair of the subassemblies, certain general instructions which apply to all units of the transmissions must be followed. These instructions are given here to avoid unnecessary repetition. For Cleaning and Inspection procedures of detail parts refer to Part 7-1.

Handle all transmission parts carefully to avoid nicking or burring the bearing or mating surfaces.

Lubricate all internal parts of the transmission before assembly with automatic transmission fluid. **Do not use any other lubricants.** Gaskets and thrust washers may be coated with Vaseline to facilitate assembly. Always install new gaskets when assembling the transmission.

Tighten all bolts and screws to the recommended torque.

FRONT PUMP AND STATOR SUPPORT

1. Remove the five bolts that attach the stator support to the front pump housing. Remove the stator support shaft from the pump housing (Fig. 27).

2. Remove the clutch apply oil rings.

3. Inspect the clutch drum front (selective) thrust washer for wear. Inspect the primary sun gear (turbine) shaft bushing in the stator support shaft.

4. Lift the rotor and slippers and slipper rings from the front pump housing. Check the pump housing and slippers for excessive wear.

5. The converter pressure relief valve and converter-out check valve may be removed from the pump housing (Fig. 27).

6. Inspect the converter pump drive hub bushing in the front pump housing. Inspect the pump drive hub seal in the pump housing. If a new seal is to be installed, use the tool shown in Fig. 28 (Falcon) or Fig. 29 (Comet).

7. To assemble the front pump, place the rotor in the pump housing with the flat side up.

8. Install the seven slippers and springs between the rotor and pump housing. Make sure each spring bottoms in the spring hole in the slipper.

9. Place the stator support in the pump housing and install the five bolts. Torque the bolts to specification.

10. Check the pump for rotation by placing it on the converter pump drive hub in normal running position and turning the pump housing.

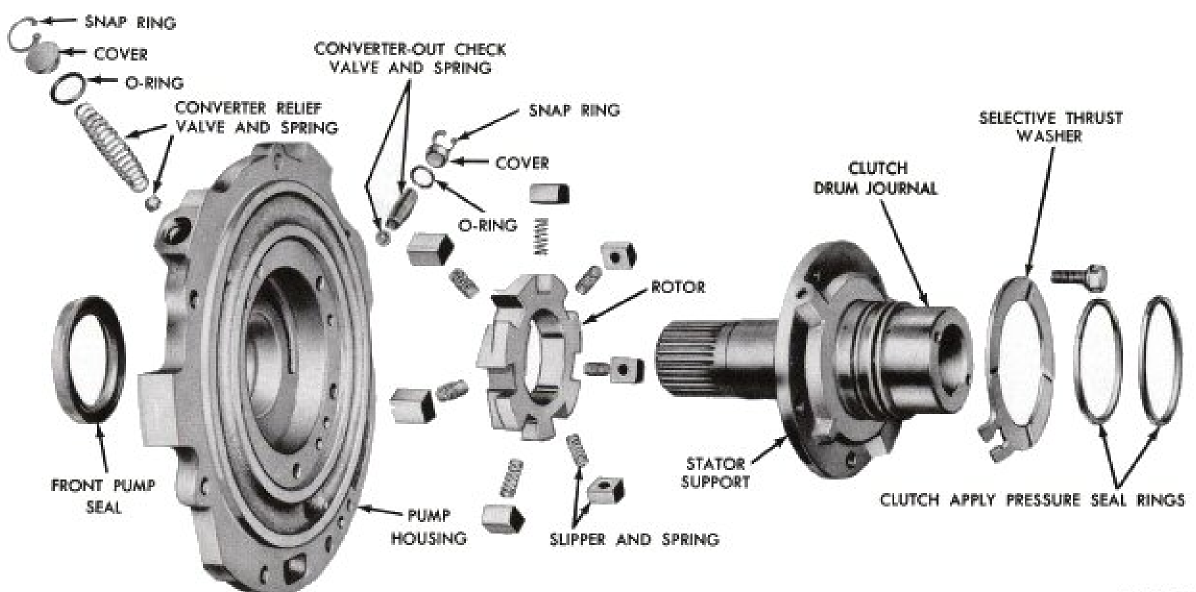


FIG. 27—Front Pump and Stator Support

FIG. 28—Front Pump Seal Installation—Falcon

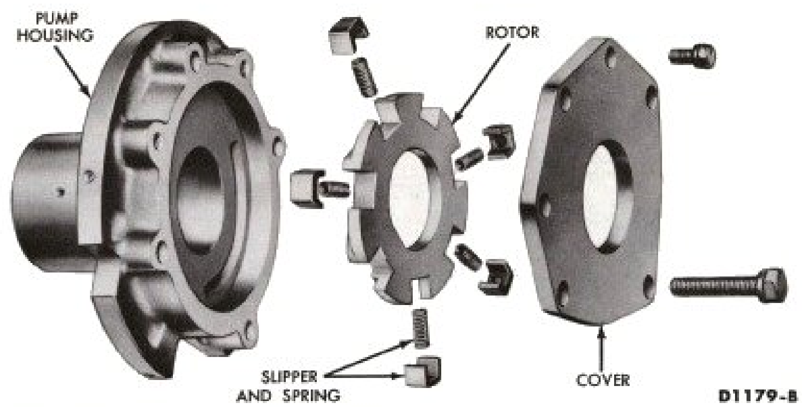


FIG. 30—Rear Pump—Disassembled

REAR PUMP

1. Remove the screws that attach the rear pump cover plate to the housing. Remove the cover plate (Fig. 30). **Note the spacing of the five slippers in the rotor.**

2. Remove the rotor, slippers and springs.

3. To assemble the rear pump, place the rotor in the pump housing with the flat side up. Turn the rotor so that the flat surface on the ID is toward the bottom of the pump housing. Install the five slippers and springs between the rotor and housing (Fig. 30).

4. Place the cover on the pump housing and torque the screws to specification.

5. Install the pump on the output shaft in its normal running position. Check the pump for free rotation by turning the pump housing.

Before removing the pump from the output shaft, make sure that the flat surface on the pump rotor ID is toward the bottom of the pump housing.

GOVERNOR

1. Remove the two screws that attach the governor cover and plate to the housing (Fig. 31).

2. Remove the governor valve from the housing.

3. Inspect the governor valve and housing for wear. **Crocus cloth may be used to polish the valve if care is taken to avoid rounding the sharp edges of the valve.**

4. Install the governor valve in the valve body and check the valve for free movement. The valve should fall of its own weight when dry.

5. Install the governor body end plate cover, and torque the screws to specification.

HIGH CLUTCH

1. Remove the snap ring that retains the forward sun gear and flange in the clutch drum (Fig. 32). Lift the gear and flange out of the drum.

2. Remove the clutch plate pack and the clutch hub.

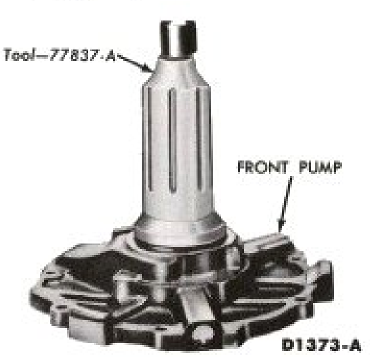


FIG. 29—Front Pump Seal Installation—Comet

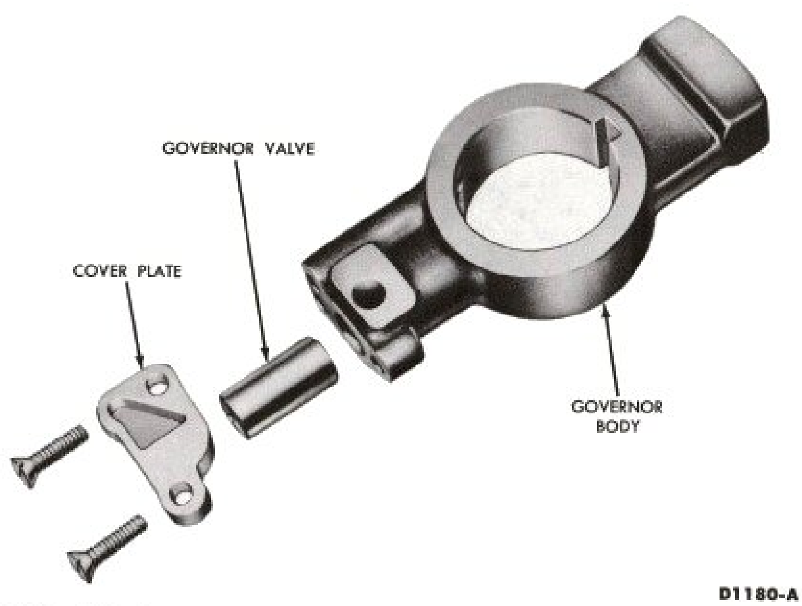


FIG. 31—Governor

FIG. 32—Typical Clutch Drum Assembly

3. Place the tool shown in Fig. 33 on the clutch piston return spring retainer, and then place the clutch drum under a press. Compress the spring and remove the snap ring. **Guide the spring retainer as the press ram rises, so that the retainer does not slide into the snap ring groove.**

4. Place the clutch drum on the completely assembled stator support shaft and front pump housing (Fig. 34). Apply air pressure at the point shown to force the piston out of the clutch drum.

5. Remove the piston outer seal from the piston and the piston inner seal from the drum (Fig. 35).

6. Inspect the drive plates for damage (Fig. 32). These plates should be flat. If there is any visible dish in them, they must be replaced. If the old plates are to be reused, they must **not** be cleaned in a vapor degreaser or cleaned with any sort of detergent solution. Wipe them clean with lint-free towels.

If new drive plates are to be installed, soak them in automatic transmission fluid for at least 15 minutes before assembling them in the clutch drum. This soaking prevents damage to the plates during the transmission fluid fill period and initial "running-in".

7. Install a new piston inner seal in the clutch drum (Fig. 35). Install a new outer seal on the clutch piston. Lubricate the piston seals with automatic transmission fluid, and install the piston in the clutch drum.

8. Place the clutch piston return spring and spring retainer on the piston. Place the clutch drum under a press (Fig. 33) and install the spring retainer snap ring.

9. **Use only Ford non-metallic drive plates.** Refer to Part 7-4 for the correct number of clutch plates per transmission model.

10. After the correct number of clutch plates has been installed in the drum, install the clutch hub. **There is no washer between the clutch hub and the forward sun gear flange.**

11. Install the integral forward sun gear and flange in the clutch drum, and then install the snap ring. Make sure the snap ring is properly seated.

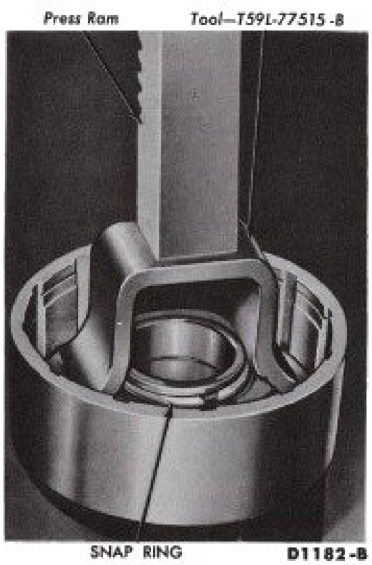


FIG. 33—Clutch Spring Snap Ring Removal

CONTROL VALVE BODY

Disassembly. Different control valve bodies are used for each type transmission. Each valve body is identified by a number stamped on the lower body. See the Master Parts Catalog for valve body application.

1. Remove the manual valve (Fig. 36).

2. Remove the control pressure regulator valve spring retainer, spring and spring seat. Remove the control pressure regulator valve.

3. Remove the hold-down plate near the compensator cut-back valve cover, and then remove the cover plate. Remove the compensator cut-back valve spring and valve from the lower body.

4. Remove the 1-2 shift valve governor plug cover plate, and then remove the plug.

5. Remove the compensator valve cover plate. Maintain pressure on this cover against the spring force until all the screws are removed.

6. Remove the compensator valve spacer pin and spring. Remove the compensator valve. Install the hold-down plate and screw so that the separator plate is held on the upper body. Remove the compensator valve spring.

7. Remove the 1-2 shift valve and orifice control valve cover plate. Remove the throttle pressure reducing valve and spring from the lower body. Remove the orifice control valve spring, valve, and the orifice control valve plug.

8. From the upper body (Fig. 36), remove the downshift valve plate.

9. Remove the downshift valve and spring.

10. From the opposite end of the upper body, remove the throttle boost valve plug stop, plug, boost valve and spring, and the throttle valve stop plate and valve.

11. Remove the three screws (10-24) and the five bolts (¼-20) which hold the upper body, separator plate, and lower body together.

12. Lift the upper body and separator plate from the lower body. Remove the rear pump check valve and spring. Remove the rear pump intake check ball from the lower body.

13. To remove the 1-2 valve from

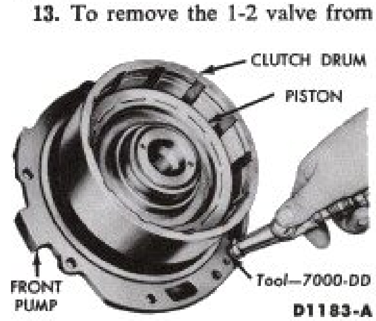


FIG. 34—Clutch Piston Removal

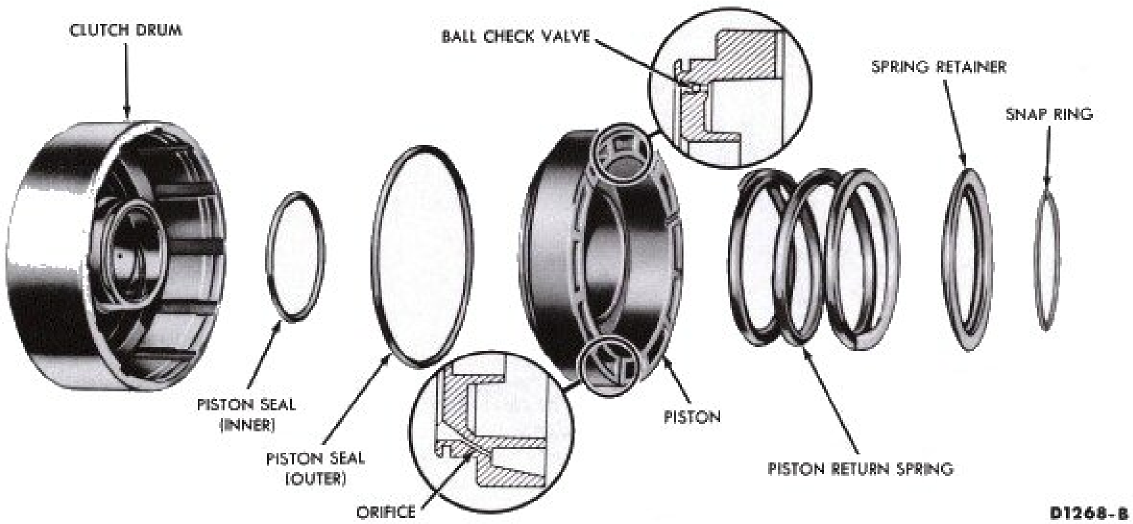


FIG. 35—Clutch Drum and Piston

the lower body, compress the 1-2 valve outer spring in the direction of the throttle reducing valve, and then remove the spring seat with needle nose pliers. With the spring seat removed, the 1-2 valve can be pushed out the throttle pressure reducing valve end. Remove the 1-2 valve outer spring.

14. Turn the upper body and separator plate over so that the separator plate is up. Remove the hold-down plate and screw. Lift the separator plate from the upper body.

15. From the upper body, remove the front pump check valve and spring. Remove the orifice control valve by-pass check ball. Remove the rear service check ball (Fig. 36).

Assembly. The assembly procedure given below permits installing each valve, except the 1-2 valve, in its respective bore with the upper and lower bodies attached together at normal torque. The 1-2 valve must be installed before the bodies are bolted together. Refer to Part 7-4 for the proper spring application for the control valve bodies that are used.

1. Place the upper valve body on the bench and secure the separator plate with one screw as shown in Fig. 37. Install the orifice control valve by-pass check ball.

2. Place the rear servo check valve in the pocket of the upper body. Make sure the ball is in the recessed area of the body (Fig. 37).

3. Hold the front pump check valve and spring in place as shown in Fig. 37.

Slide the separator plate into position and install another screw, as shown, to secure the plate. **Tighten both screws to prevent the rear servo check ball from rolling out of the pocket and into the rear servo apply passage.**

4. Assemble the 1-2 valve spring, 1-2 valve, and the 1-2 valve spring seat in the lower body. Place the rear pump check valve and the rear pump intake check ball in the lower body.

5. Place the upper control valve body and separator plate assembly on the lower body. Install the five bolts (¼-20) which attach the upper and lower control valve bodies. Install the three screws (10-24) which also attach the upper and lower control valve bodies. Remove the two screws installed to hold the separator plate on the upper body and install the hold-down and throttle valve stop plates. Torque the bolts and screws to specifications.

6. With the upper and lower control valve bodies at normal assembled torque, check the 1-2 valve for free movement (Fig. 36). Check and adjust the bolt and screw torque as required, to obtain free movement on the 1-2 shift valve.

7. In the upper body, install the downshift spring, and valve (Fig. 36). Install the hold-down plate and screws. Torque the hold-down plate and cover screws to specification.

8. At the opposite end of the upper body, install the throttle valve and stop plate, and the throttle boost valve spring, valve, plug, and retainer.

9. In the lower body, install the compensator valve and spring (Fig. 36). Install the compensator pin in the spacer and install them into the valve body. Install the compensator cover plate and torque the retaining screws to specifications. When it is necessary to adjust the spring loaded screw in the compensator cover plate, refer to the In-Car Adjustment Section (Fig. 15) for adjustment procedures.

10. Install the 1-2 shift valve inner spring and the throttle pressure reducing valve.

11. Install the orifice control valve plug, orifice control valve and spring. Install the cover plate for the throttle reducing valve and orifice control valve. Torque the screws to specification.

12. In the lower body, install the 1-2 valve governor plug. Install the cover plate, and torque the screws to specification.

13. Install the compensator cutback valve and spring. Refer to Specification Section Part 7-4 for proper spring application. Install the cover plate, and torque the attaching screws to specification.

14. Install the control pressure regulator valve, spring seat, and spring. Compress the control pressure regulator valve spring and install the spring retainer.

PLANETARY GEAR SYSTEM

The primary sun gear must be

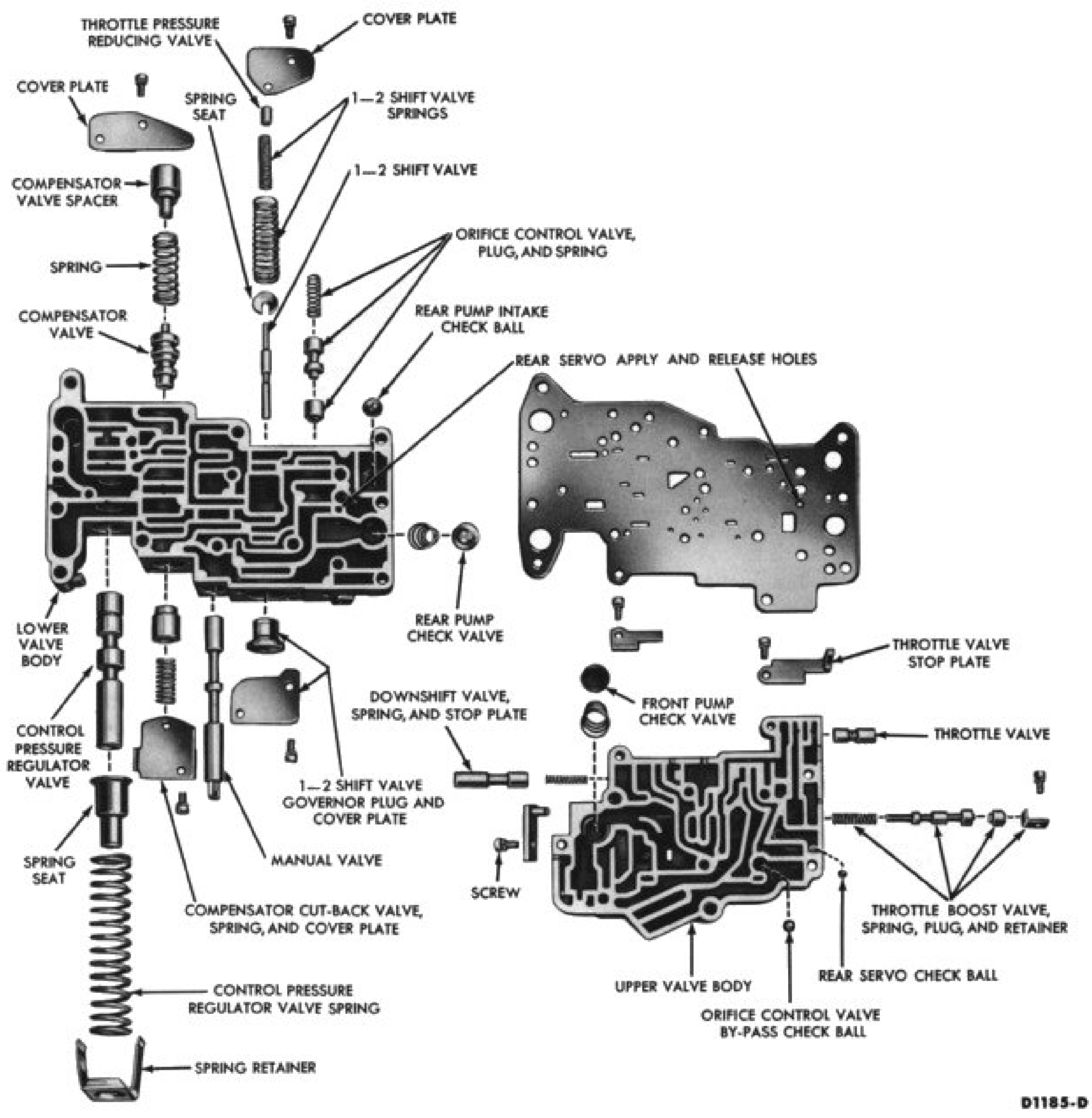


FIG. 36—Control Valve Body

removed from the pinion carrier to inspect the primary sun gear front thrust bearing and race, the primary sun gear rear thrust washer, and the primary sun gear pilot bushing. To remove the primary sun gear from the pinion carrier, the short pinions must be removed from the pinion carrier housing.

Pinion Carrier Disassembly

1. Mark the pinion shafts so that they can be reassembled in the same locations.

2. Remove the screws that attach the pinion shaft retainer to the pinion carrier. Turn the retainer counterclockwise until the shafts are unlocked. The overhaul fixture shown in Fig. 38 permits removing only one pinion shaft at one time.

3. With the tool shown in Fig. 38, push a short pinion shaft up from the bottom until the tool clears the top of the gear spacer. Now, slide the short pinion and its upper and lower thrust washers out the pinion carrier window. **To avoid loss of needle bearings, carefully keep both washers in position against the pinion.** Retain the needle bearings and spacer in the short pinion by pushing the tool out with the removed shaft. Remove the gear spacer.

4. Remove the two remaining

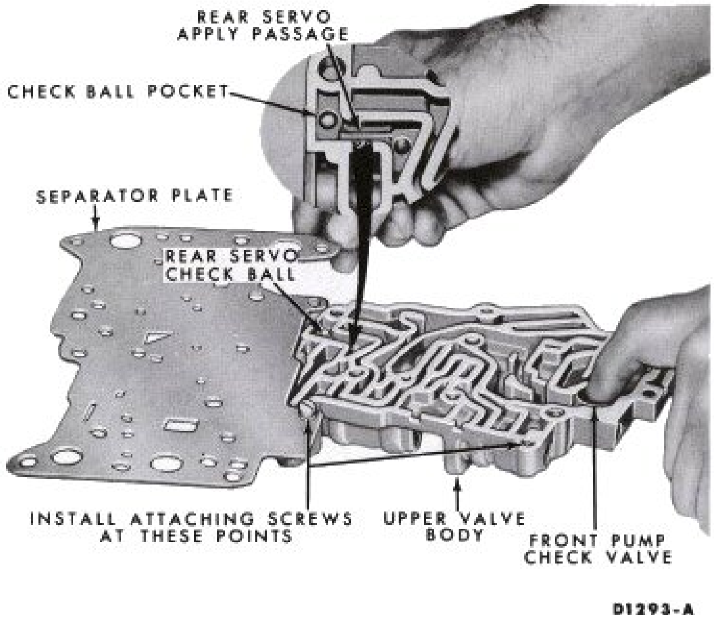


FIG. 37—Rear Servo Check Ball Location

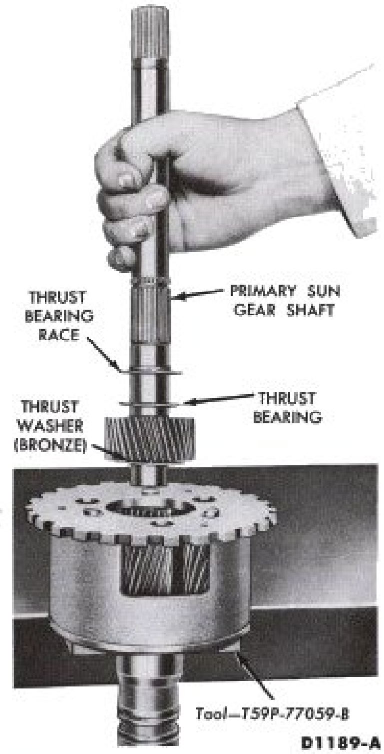


FIG. 39—Primary Sun Gear Removal or Installation

short pinions and spacers, using the same procedure.

5. Remove the integral primary sun gear and shaft (Fig. 39).

6. With the tool shown in Fig. 40, push a long pinion shaft up until the tool just clears the pinion carrier bottom plate. Remove the long pinion gear with its top and bottom thrust washers out the center of the pinion carrier. With the pinion shaft, push the tool out of the gear. The shaft will hold the needle bearings,

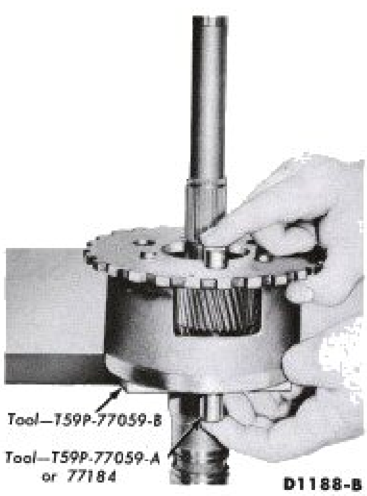


FIG. 38—Short Pinion Removal or Installation

spacer, and thrust washers in position.

7. Remove the remaining two long pinion gears, using the same procedure.

Pinion Carrier Assembly

1. Place a spacer (Fig. 41) in a long pinion, and then insert the dummy shaft (Fig. 40) through the long pinion and needle bearing spacer.

2. At each end of the gear, add a row of 23 needle bearings.

3. Place a thrust washer on each end of the gear. Retain the washer to the gear with Vaseline.

4. While holding the long pinion assembly together, place it in position in the pinion carrier. Use the marked shaft for this location to push the dummy shaft out the bottom.

5. Using the same procedure, install the remaining long pinions.

6. Place the primary sun gear front thrust bearings and thrust bearing race on the primary sun gear shaft (Fig. 39). Place the bronze thrust washer on the pilot at the rear of the primary sun gear. Hold the washer in place with Vaseline. **Make sure the concave side of this dished washer is toward the rear of the transmission.**

7. Place the primary sun gear shaft in the pinion carrier (Fig. 39).

8. Place a spacer (Fig. 41) in a short pinion, and then insert a dummy shaft through the gear and needle bearing spacer. Install a row of 29 needle bearings and a thrust washer at each end of the gear. Retain the washers in place with Vaseline.

9. Place a short pinion spacer (Fig. 41) in the pinion carrier. **To maintain pinion carrier balance,**

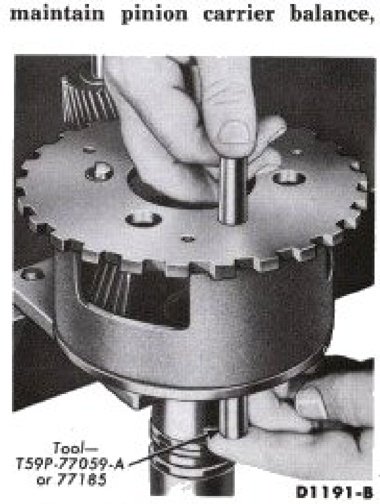


FIG. 40—Long Pinion Removal or Installation

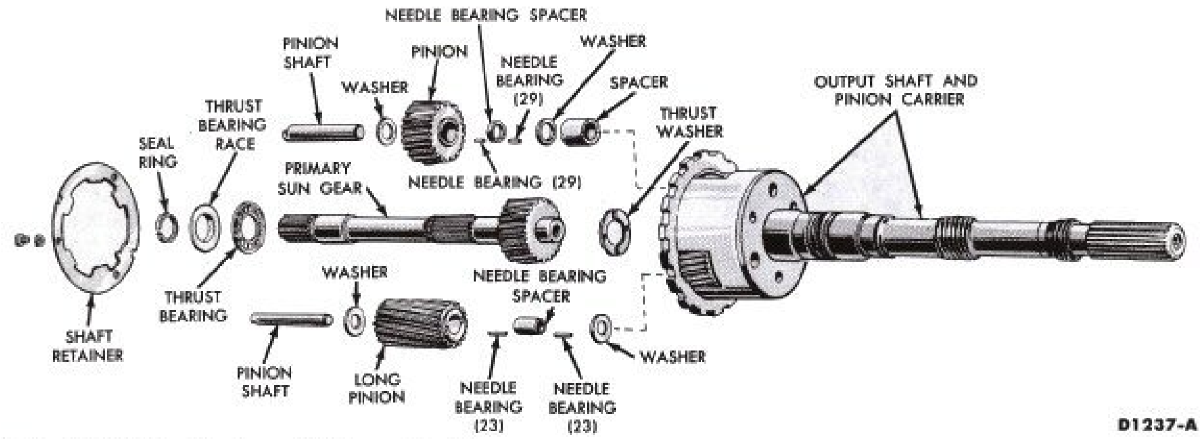


FIG. 41—Pinion Carrier and Primary Sun Gear

the short pinion spacers must be of the same material. Insert an extra pinion shaft (upside down) through the bottom of the pinion carrier and into the spacer. Hold the shaft so that it is flush with the top of the spacer.

10. Use the marked shaft for this location to push the dummy shaft and extra pinion shaft out the bottom (Fig. 38).

11. Install the remaining two short pinions, using the same procedure.

12. Position the shaft retainer (Fig. 41) on the pinion carrier and turn retainer clockwise to lock the pinion shafts in place. Install the retainer to pinion carrier screws and torque them to specification.

REVERSE SERVO

1. Remove the lock nut, adjusting nut, and the rod seat (half-ball) from the reverse servo piston rod (Fig. 42).

2. Remove the strut between the apply lever and band. Turn the band to unhook it from its anchor and remove the band.

3. Remove the upper left and lower right cover to case bolts that are 180° apart. Remove the vent tube. Install two 1⅜₆-inch long bolts. Run the bolts in until they bottom finger tight.

4. Remove the two remaining short bolts and the identification tag. Remove the cover, piston return spring, and servo piston rod.

5. Apply air pressure at the reverse servo apply passage in the case (Fig. 43) and force the reverse servo piston out of the case.

6. Remove the servo piston outer seal. The servo piston guide may be removed from the piston by removing the lock ring on the piston guide.

7. Inspect the servo piston and piston bore for wear and roughness.

8. Install a new seal on the servo piston. Install the piston in the case. Insert the piston rod through the servo and into the case.

9. Place a new seal on the servo cover. **Do not twist the seal.**

10. Position the return spring and the cover. Start two 1⅜₆-inch long bolts into the upper left and lower right bolt holes that are 180° apart.

11. Carefully pull the cover against the case by tightening the two long bolts until they bottom.

12. Start the two short bolts and tighten them carefully. Remove the two long bolts and install the vent tube and the two remaining short bolts. Be sure to place the identification tag on the lower rear cover bolt. Torque the cover bolts to specification.

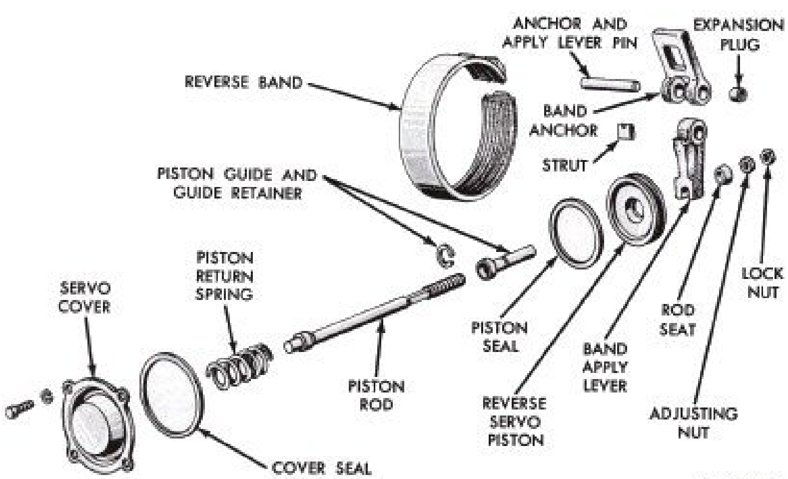


FIG. 42—Reverse Servo Piston and Band Apply Linkage

LOW SERVO

1. Remove the servo cover retaining bolts (Fig. 44).

2. Remove the servo cover, piston, and spring.

3. Inspect the servo piston and piston bore for excessive wear and roughness.

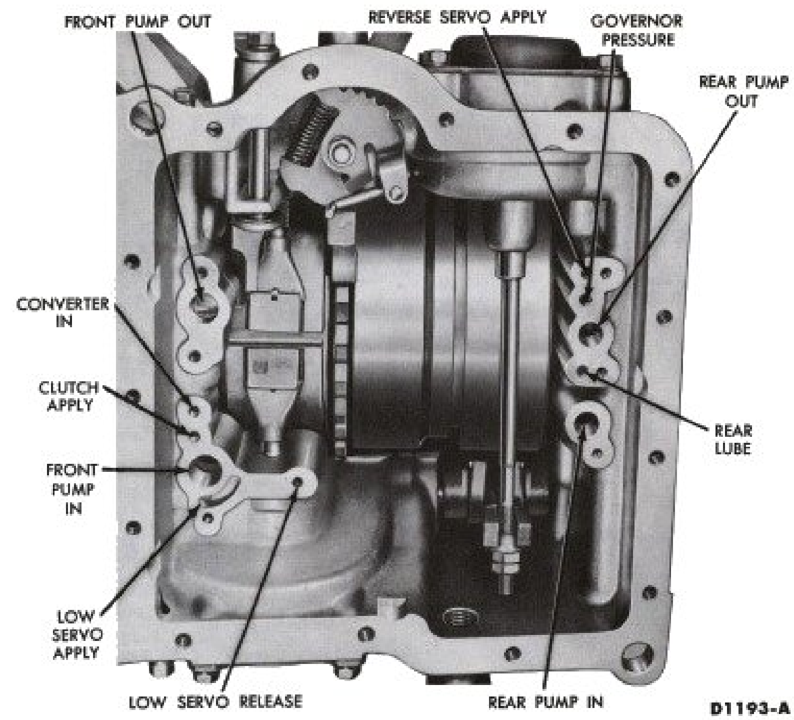


FIG. 43—Transmission Case Fluid Passages

4. Check the low servo piston return spring against the specifications given in Part 7-4. **If the proper spring is not installed, the low band release will not be synchronized with clutch application and the shift will be rough.**

5. Install a new seal on the low servo piston. Install a new seal on the servo cover.

6. Place the piston return spring, piston, and cover in position in the case. **The low servo piston ball check valve (Fig. 44) must be at the top, when the transmission is in normal running position.**

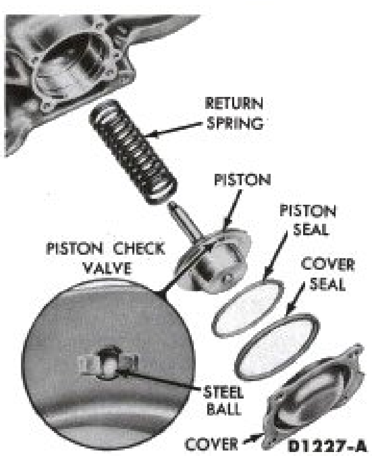


FIG. 44—Low Servo Assembly

7. Carefully pull the cover against the case by tightening the bolts until they bottom finger tight.

8. Torque the cover bolts to specification.

THROTTLE LINKAGE

1. Remove the nut and lockwasher from the downshift lever shaft (Fig. 45). Remove the outer downshift lever from the shaft.

2. Remove the shaft and inner downshift lever from inside the case. Then remove the conical spring.

3. Remove the O-Ring from the counterbore at the outer end of the downshift lever shaft hole. Install a new O-ring.

4. Place the conical spring on the downshift lever shaft with the large end of the spring against the inner downshift lever.

5. Insert the downshift lever shaft into the case. Install the outer lever on the shaft, and then install the lockwasher and nut. Torque the nut to specification.

MANUAL LINKAGE

1. Remove the nut and lockwasher from the manual lever shaft (Fig. 45).

2. Remove the detent lever, detent plunger and spring, and the parking pawl engaging lever to detent lever spring. Remove the parking pawl engaging lever.

3. Remove the manual lever shaft from the case. Remove the O-ring at the outer shaft hole counterbore.

4. Release the parking pawl return spring tension. Slide the parking pawl pin out of the front of the case. Remove the parking pawl and pawl spring.

5. Place a new O-ring in the manual lever shaft hole counterbore. Install the manual lever and shaft in the case (Fig. 45).

6. Place the parking pawl engaging lever on the shaft.

7. Place the detent spring and plunger in the case and then install the detent lever on the shaft. Install the lockwasher and nut on the shaft. Torque the nut to specification.

8. Compress the pawl engaging lever to detent lever spring and install it between the levers.

9. Position the parking pawl and spring in the case and then insert the pawl pin. Hook the spring to the pawl.

REVERSE BAND APPLY LINKAGE

1. Drill a 5/16-inch hole through the expansion plug at the back of the reverse band anchor and apply lever pin (Fig. 42).

2. Thread a 1/4-20 bolt (through the drilled hole) into the apply lever pin. If the pin and plug cannot be pulled out by hand, attach tool T50T-7140-B to the bolt head, and then attach slide hammer T-59L-100-B to the tool.

3. Remove the apply lever and anchor from the case.

4. To assemble the reverse band apply linkage, place the lever and anchor in position, insert the pin, and install a new expansion plug.

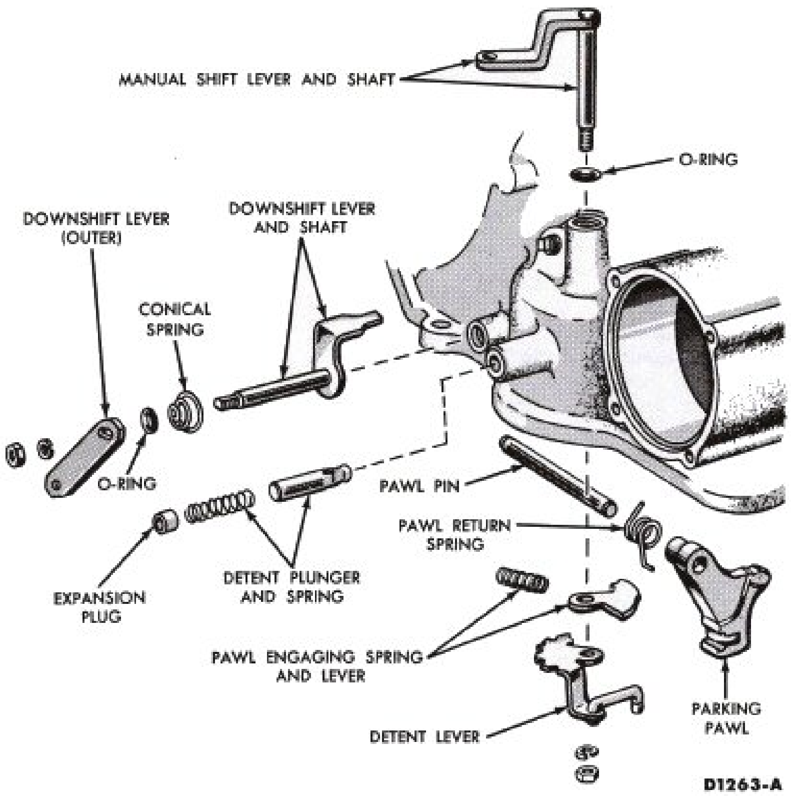


FIG. 45—Typical Throttle and Manual Linkage

ASSEMBLY

TRANSMISSION CASE

1. Install the rear oil pump in the case. Install but do not tighten the pump attaching bolts.

2. Place the reverse band in the case. **The band end having a guide pin for the strut goes toward the apply lever strut.** Make sure the anchor end of the band engages the band anchor. Compress the band and install the strut between the band apply lever and the band.

3. Position the reverse servo apply rod in the band apply lever. Start the rod seat (half-ball), adjusting nut, and locknut on the apply rod.

4. Place the reverse ring gear rear thrust washer on the rear pump extension at the rear of the case.

5. Install the reverse ring gear on the rear pump extension.

GEAR TRAIN INSTALLATION

1. Place the reverse ring gear front thrust washer on the output shaft and against the flange at the pinion carrier.

2. Install the governor pressure seal rings on the output shaft. The ring gaps should be at the top as the output shaft is installed. As the output shaft is installed, the flat surface which drives the rear pump must engage the rotor (Fig. 46).

3. Install the output shaft in the case. Some difficulty may be experienced in starting the output shaft flat surface into the rear pump rotor. The flat on the output shaft and the flat in the rotor should be up (acually toward the bottom of the transmission). The slipper springs will position the rotor in the center. Its normal running position is off-center and toward the bottom of the transmission. When the flat on the output shaft comes in contact with the rotor, lift the rotor with a small screwdriver while keeping steady pressure on the output shaft. When the flats align, the output shaft will slip into position.

If the rotor and output shaft will not align, remove the pump cover plate, rotor, and slippers. Slide the output shaft into normal running position. Assemble the rotor on the output shaft and in the pump housing. Install the slippers and slipper springs. Install the cover plate and attaching bolts and screws.

As the bolts are tightened, check the pump for free rotation. Torque the bolts and the screws to specifications.

Tool 77717 may be used to align the output shaft with the rear pump drive gear (Fig. 47). After the gear train has been installed remove Tool 77717.

4. Install the low band, inserting it through the front of the transmission case. **The end of the band having a guide pin for the strut goes to the adjusting screw side.** Install the band struts.

5. Install the clutch in the case and on the primary sun gear (turbine shaft). Mesh the forward sun gear with the short pinion and then bottom the forward sun gear on the primary sun gear front thrust bearing and race.

6. Install the converter-out pressure seal ring on the primary sun gear shaft. This ring groove is in the clutch hub spline.

7. Using the end play reading which was taken during disassembly, select the proper selective thrust washer to be installed on the stator support shaft (Fig. 27). Selective thrust washers are available in the thicknesses of 0.067-0.069, 0.074-0.076, 0.083-0.085, and 0.092-0.094 inch.

8. Install the clutch apply pressure seal rings on the stator support shaft.

9. Place a new gasket on the pump housing, and using new front pump

FIG. 46—Rear Pump Rotor Alignment

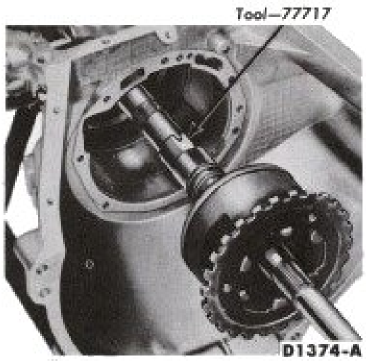


FIG. 47—Pinion Carrier and Output Shaft Installation—Comet

bolts. Install the pump in the case. Be careful not to break the converter-out pressure ring seal. Torque the bolts to specification.

10. Install the governor ball, governor, and retaining ring on the output shaft (Fig. 24).

11. Place a new gasket on the transmission case, and install the extension housing. Torque the housing to case bolt to specification.

12. Install the extension housing seal replacer tool in the extension housing to align the output shaft. Check the gear train end play (Fig. 23).

13. If the end play is not within 0.020-0.039 inch, change the selective washer (Fig. 27) to bring the end play within these limits.

BAND ADJUSTMENTS

Low Band

1. Tighten the low band adjusting screw with the special torque wrench (Figs. 11 and 12) until the wrench is felt and heard to click. This tool is a pre-set torque wrench which clicks and overruns when torque on the screw reaches 10 ft-lbs.

2. At the point the wrench overruns, back off the adjusting screw exactly two turns.

3. Hold the adjusting screw at this position and torque the locknut to specification.

Reverse Band

1. Place the tool (Figs. 13 and 14) on the rear servo piston rod so that the two forks straddle the band apply lever. The inner fork must engage the flat on the servo piston rod. The outer fork must be inserted between the rod seat (half-ball) and the adjusting nut. This fork provides a ¼-inch spacer between the rod seat and the adjusting nut.

2. Tighten the adjusting nut until the wrench is felt and heard to click and overrun. This tool is a pre-set torque wrench which clicks and overruns when 45-50 inch-pounds torque is applied to the adjusting nut.

3. Back off the adjusting nut exactly two turns.

4. Pull the tool away from the servo rod about one inch. This will permit the adjusting nut to drop into a nut holding slot provided in the tool.

5. Hold the adjusting nut against rotation and tighten the locknut against it to specification.

6. Remove the tool from the piston rod.

CONTROL VALVE BODY—VACUUM UNIT AND OIL PAN INSTALLATION

1. Position the control valve body on the case. Be sure the inner downshift lever is between its stop on the upper body and the downshift valve and that the throttle valve to vacuum diaphragm rod enters the valve and diaphragm unit. Connect the detent plate link to the manual valve.

2. Install the six control valve body to case bolts (Fig. 17) and torque them to specification.

3. Install the vacuum unit and control rod.

4. Install the oil screen and screen clip.

5. Place a new gasket on the transmission case and install the oil pan. Torque the pan bolts to specification.

6. Install the converter.

HYDRAULIC SYSTEM BENCH TESTS

After the transmission has been assembled and is ready for installation in the car, the hydraulic system should be checked to make sure it is operating properly. These hydraulic tests can be made on the bench so that most malfunctions of the system can be corrected before the transmission is installed in the car.

1. Install a plug in the filler tube fitting in the case. Tilt the transmission, and then pour four quarts of transmission fluid into the transmission through the speedometer gear opening.

2. Install the converter on the transmission and in its normal running position.

3. Install the special tool for bench testing the transmission (Fig. 48).

This tool makes it possible to drive the converter with a ½-inch chuck drill motor. The tool locates the converter in its normal running position and holds it there.

4. Remove the ⅛-inch pipe plug from the left-hand side of the case.

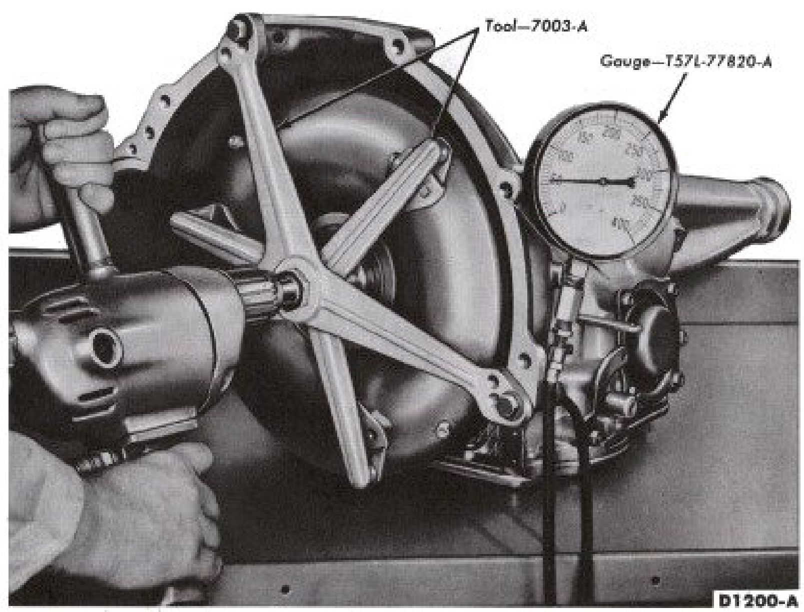


FIG. 48—Hydraulic System Bench Test

Fasten the drill motor chuck to the transmission input shaft. **Hold a shop towel over the open hole in the left side of the case.**

Operate the drill motor on and off for periods of approximately two seconds until a steady fluid flow leaves the hole in the case. This operation "bleeds" the air from the pump.

5. Install the pressure gauge (77820 or T57L-77820-A) as shown in Fig. 48.

6. Turn the converter to turn the front pump at approximately 350 rpm, and note the gauge readings. The gauge reading at all selector lever positions must be within limits given for engine idle (Table 2, Part 7-1).

As soon as control pressure reaches normal value, flow to the converter starts. If, therefore, bench testing has to be carried on for an extended period, more fluid will have to be added to the transmission sump and a tube or hose should be installed between the converter-out and cooler return connections on the right hand side of the case. This will permit normal flow in and out of the converter, and will test the transmission's capacity to fill the converter.

PART 7-4 SPECIFICATIONS

C4 AUTOMATIC DUAL RANGE TRANSMISSION

CONTROL PRESSURE AT ZERO OUTPUT SHAFT SPEED

Engine Speed	Throttle	Manifold Vac. Ins. HG.	Selector Lever Position	Control Pressure (PSI)
Idle	Closed	*Above 18	P, N, D1, D2, L	55-62
			R	55-96
As Req'd	As Req'd.	17.5-16.5	D1, D2, L	Pressure Starts to Increase
As Req'd.	As Req'd.	10	D1, D2, L	95-110
As Req'd.	As Req'd.	3	D1, D2, L	138-148
			R	213-227

*Vehicles Checked at High Altitudes.

At altitudes above sea level it may not be possible to obtain 18" of engine vacuum at idle. For idle vacuums of less than 18" refer to following table to determine idle speed pressure specification in forward driving ranges (D1, D2 or L).

Engine Vacuum	Control Pressure (PSI)
17	55-65
16	55-71
15	55-77
14	55-83
13	55-89
12	55-95
11	55-101

LUBRICANT REFILL CAPACITY

Approximate Capacity—Quarts	8.5

CHECKS AND ADJUSTMENTS

Operation	Specification
Transmission End Play Check	0.880-0.042 *Selective Thrust Washers Available
Turbine and Stator End Play Check	0.060 inch (maximum)
Intermediate Band Adjustment	Adjust screw to 10 foot pounds torque, and back off 1½ turns
Low-Reverse Band Adjustment	Adjust screw to 10 foot pounds torque, and back off three turns
Forward Clutch Pressure Plate to Snap Ring Clearance	0.022 to 0.041 inch Selective Snap Ring Thicknesses 0.092-0.088 0.078-0.074 0.064-0.060

STALL SPEED LIMITS

Engine Model	Engine Speed (rpm)
260-V8	1650-1850
289-V8	1750-1950

CLUTCH PLATES

Transmission Model	Reverse-High Clutch		Forward Clutch	
	Steel Plates	Composition Plates	Steel Plates	Composition Plates
PCW-D (260)	4	4	3	4
PCW-E (289)	4	4	3	4

CONTROL VALVE BODY SPRING IDENTIFICATION

Spring	Total Coils	Free Length	O.D.	Wire Diameter	Lbs. Load at Length	
Main Oil Pressure Reducer Valve	19	1.42	.281	.035	3.012	.887
Cut Back Control Valve	19	1.00	.200	.020	1.05	.59
Manual Valve Detent	10	.74	.300	.047	8.0	.601
3-2 Coasting Control Valve	10	.83	.285	.023	1.0	.476
Line Pressure Relief	17	1.15	.198	.041	7.0	.80
Secondary Throttle Valve	14	1.581	.350	.026	1.728	.565
2-3 Backout Control Valve	11½	1.26	.45	.032	1.47	.580
Main Oil Pressure Regulator Valve	16	1.92	.48	.049	9.09	.876
Throttle Pressure Modulator Valve	19	1.29	.29	.029	2.15	.620
Control 1-2 Shift Valve	14	1.58	.26	.026	1.7	.70
Throttle Downshift Valve	12	.79	.24	.023	1.15	.48
2-3 Shift Valve	6½	1.18	.53	.031	1.38	.39
Throttle Pressure Booster Valve	16¾	1.589	.311	.035	4.80	.84

C4 AUTOMATIC DUAL RANGE TRANSMISSION (Continued)

TORQUE LIMITS

Item	Foot Pounds
Pressure Gauge Tap Plug	9-15
Intermediate Servo Cover to Case Bolts	12-20
Low-Reverse Servo Cover to Case Bolts	12-20
Downshift Lever to Case Nut	12-20
Support Assy. to Front Pump Bolts	12-20
Oil Pan to Case Bolts	12-16
Distributor Sleeve to Case Bolts	12-20
Reverse Servo Piston to Shaft Nut	12-20
Outer Race to Case Bolts	13-20
Diaphragm Assy. to Case	15-23
Converter Drain Plug	20-30
Ext. Hsg. to Case Bolts	28-40
Converter Housing & Pump to Case Bolts	28-40
Intermediate Band Adj. Stop to Case Nut	35-45
Low-Reverse Band Adj. Stop to Case Nut	35-45
Manual Lever to Shaft Nut	35-45
End Plate to Valve Body Screw	20-35
Lower to Upper Valve Body Bolts	20-35
Screen to Valve Body Screws	20-35

TORQUE LIMITS (Continued)

Item	Inch Pounds
Neutral Switch to Case Screws	30-45
Screen to Valve Body Bolt	80-120
Screen and Valve Body to Case Bolts	80-120
Governor Bodies to Distributor Body Bolts	80-120
Cooler Line Fittings	80-120

*SELECTIVE THRUST WASHERS (No. 1 and 2 Used in Pairs)

Thrust Washer No. 1		Thrust Washer No. 2	
Composition Thrust Washer	Color of Washer	No. Stamped on Washer	Metal Thrust Washer
0.108-0.104	Blue	5	0.109-0.107
0.091-0.087	Yellow	4	0.092-0.090
0.074-0.070	Black	3	0.075-0.073
0.057-0.053	Tan	2	0.058-0.056
0.042-0.038	Green	1	0.043-0.041

SHIFT SPEEDS (APPROXIMATE)

Axle Ratio	Automatic Shift Speeds (mph)								Manual Shift Speeds (mph)
	D1		D1 or D2		D1	D1 or D2	D1	D2	L
	1-2 Minimum Throttle	1-2 Maximum Throttle	2-3 Minimum Throttle	2-3 Maximum Throttle	3-1 Minimum Throttle	3-2 Maximum Throttle	2-1 or 3-1 Maximum Throttle	3-2 Minimum Throttle	2-1 Minimum Throttle
3.00:1 3.25:1	8-10	31-41	12-24	54-71	10 (Max.)	64 (Max.)	33 (Max.)	10 (Max.)	22 (Max.)
2.80:1	9-11	36-44	14-25	64-76	11 (Max.)	69 (Max.)	35 (Max.)	11 (Max.)	25 (Max.)

FORDOMATIC—MERCOMATIC SINGLE RANGE TRANSMISSION

TORQUE LIMITS

Screws or Bolts		Ft-Lbs.
Control Valve Body	Screws (10-24)	20-30*
	Bolts—Upper to Lower Body (¼-20)	70-85*
	Bolts—Body to Transfer Case (¼-20)	8-10
Cover—Governor Body		20-30*
Planet Gear Shaft Retainer to Output Shaft Carrier		20-30*
Cover—Rear Pump to Body		50-60*
Oil Pan to Case		10-13
Cover—Front or Rear Servo to Case		12-15
Support—Converter Stator to Front Pump		12-17
Pump to Case—Front		18-22
Pump to Case—Rear		12-15
Extension to Case		28-38
Nuts		
Lever—Manual Control Shaft to Case		12-16
Lever—Throttle or Downshift to Case—Outer		12-16
Seat—Rear Band Servo Piston Rod		15-18
Stop—Front Band Lock		35-40
Diaphragm Assembly to Case		15-18†
Nut—Oil Filler Tube to Case		45-55

TORQUE LIMITS (Continued)

Plugs	Ft-Lbs.
Drain—Oil Pan	10-15
Drain—Converter Cover	20-38
Front Servo Mfg. Holes	10-15
Gauge Hole in Case	10-15
Cooler Inlet or Outlet	9-12
Cooler Outlet Fitting	10-15
By-Pass Tube or Tube Connector	9-12

*Inch-Pounds †Use 24 tool FCO Modified

CLUTCH PLATE AND CLUTCH PISTON TABLE

Transmission Model	Engine (C.I.D.)	Number of Internal Plates Splined	Number of External Plates Splined	Clutch Piston Thickness (Inches)
PCM-6	170	2	3	0.896 to 0.906
PCL-6	144	2	2	0.967 to 0.977
PCP-6	260	4	4	0.615 to 0.625
PCY	208	3	3	0.790 to 0.800

LUBRICANT REFILL CAPACITY

Approximate Capacity (Quarts)	7½

FORDOMATIC—MERCOMATIC SINGLE RANGE TRANSMISSION (Continued)

CHECKS AND ADJUSTMENTS

Operation	Specification
Transmission End Play Check	0.020-0.039 inch Selective Thrust Washers Available: 0.067-0.069 inch, 0.074-0.076 inch 0.083-0.085 inch, 0.092-0.094 inch
Turbine and Stator End Play Check	0.060 inch (maximum)
Front Band Adjustment	Adjust screw to 10 foot-pounds torque, and back off two full turns. Lock nut to 35-40 foot-pounds.
Rear Band Adjustment	Insert ¼-inch spacer between the piston rod seat and the adjusting nut. Adjust nut to 45-50 inch-pounds torque, and back off two turns. Lock jam nut to 15-18 foot-pounds.

GEAR RATIOS AND STALL TEST

Stall Ratio	Gear Ratio			Engine Cubic Inch Displacement	Transmission Model	Stall Speed Engine rpm
	Low	Direct	Reverse			
2.4	1.82	1.00	1.72	144-1V	PCL	1550-1750
				170-1V	PCM	1700-1900
				260-2V	PCP	1700-1900
				200-1V	PCY	1850-2050

CONTROL PRESSURE AT ZERO OUTPUT SHAFT SPEED

Engine Speed or Manifold Vacuum	Throttle Position	Shift Selector Lower Position	Control (Line) Pressure
Idle Above 15 Inches of Mercury	Closed	All	65-70
15 to 12.5 Inches of Mercury	As Required	Drive Low Reverse	Pressure Starts Rising
Stall Below 1.5 Inches of Mercury	Through Detent (Wide Open)	Drive Low Reverse	180-220

AUTOMATIC SHIFT SPEEDS (APPROXIMATE)

Engine Model	Transmission Model Prefix	Rear Axle Ratio	Automatic Shift Lever (mph) Selector Lever at D			
			1-2 Minimum Throttle	1-2 Thru Detent	2-1 Thru Detent	2-1 Closed Throttle
144 Six	PCL	3.10:1	13-18	45-52	43-51	10-15
		3.50:1	12-16	39-46	38-45	9-13
		4.00:1	10-14	36-40	35-40	8-11
170 Six	PCM	3.50:1	12-16	40-47	39-46	9-13
		3.20:1	13-17	44-52	43-50	10-14
260 V8	PCP	3.50:1	12-16	41-47	39-46	9-13
		3.10:1	13-18	45-52	43-51	10-15
200 Six	PCY	3.50:1	12-16	39-46	38-45	9-13
		4.00:1	10-14	36-40	35-39	8-11

CONTROL VALVE BODY SPRING IDENTIFICATION—PCL AND PCM MODELS

Spring Description	Free Height (inches)	Total No. of Coils	Wire Diameter (inches)	Outside Diameter (Inches) Min.	Outside Diameter (Inches) Max.
Control Pressure Regulator Valve*	4.20	14.75	.092	1.034	1.064
Control Pressure Regulator Valve†	3.82	14.75	.092	1.034	1.064
Orifice Control Valve	.93	8.75	.0258	.380	.400
Front Pump Check Valve	.84	3.75	.023	.57	.60
				.71	.74
Rear Pump Check Valve	.717	5.25	.0286	.360	.390
				.710	.740
Compensator Valve	1.73	9.0	.063	.690	.710
Throttle Pressure Reducing Valve†	1.34	20.5	.032	.278	.290
Throttle Pressure Reducing Valve*	1.28	23.25	.0286	.271	.283
Throttle Pressure Boost Valve	1.17	17.0	.032	.027	.028
Throttle Downshift Valve	1.07	13.5	.023	.235	.245
Compensator Cut-Back Valve†	1.09	9.25	.054	.51	.53
Compensator Cut-Back Valve*	.95	9.25	.054	.51	.53
1-2 Shift Valve*	2.00	10.25	.041	.637	.657
1-2 Shift Valve†	1.55	11.25	.041	.637	.657

†Used with 144 Six Engine. *Used with 170 Six Engine.

CONTROL VALVE BODY SPRING IDENTIFICATION—PCP AND PCY MODELS

Spring Description	Free Height (inches)	Total No. of Coils	Wire Diameter (inches)	Outside Diameter (Inches) Min.	Outside Diameter (Inches) Max.
Control Pressure Regulator Valve	4.20	14.75	.092	1.034	1.064
Orifice Control Valve	.93	8.75	.0258	.380	.400
Front Pump Check Valve	.84	3.75	.023	.57	.60
				.71	.74
Rear Pump Check Valve	.717	5.25	.0286	.360	.390
				.710	.740
Compensator Valve—Inner	1.73	9.0	.063	.690	.710
Throttle Pressure Reducing Valve	1.28	23.25	.0286	.271	.283
Throttle Boost Valve	1.17	17.0	.032	.27	.28
Throttle Downshift Valve	1.07	13.5	.023	.235	.245
Compensator Cut-Back Valve*	1.40	10.25	.0475	.51	.53
Compensator Cut-Back Valve†	.95	9.25	.054	.51	.53
1-2 Shift Valve†	.200	10.25	.041	.637	.657

*Used with 200 Six Engine. †Used with 260 Eight Engine.

LOW SERVO RETURN SPRING SPECIFICATIONS

Engine Model	Transmission Model	Free Height (inches)	Total Coils	Wire Diameter (inches)
144-Six	PCL	3.17	9.75	0.207
170-Six	PCM	3.18	10.75	0.207
260-V8	PCP	3.28	10.75	0.188
200-Six	PCY	3.28	10.75	0.188

ENGINE

GROUP 8

PART 8-1 GENERAL ENGINE SERVICE

This part covers engine diagnosis, tests and adjustment and repair procedures. In addition, the cleaning and inspection procedures are covered.

For engine removal, disassembly, assembly, installation and major repair procedures, refer to the pertinent part of this group.

1 DIAGNOSIS AND TESTING

DIAGNOSIS

Engine performance complaints usually fall under one of the basic headings listed in the "Diagnosis Guide." When a particular trouble can not be traced to a definite cause by a simple check, the possible items that could be at fault are listed in the order of their probable occurrence. Check the items in the order listed. For example, under "Poor Acceleration," the ignition system is listed as a probable cause of the trouble. All the conventional ignition system items that affect acceleration are listed. Check all these items before proceeding to the next probable cause.

For diagnosis of transistor ignition system malfunctions, refer to Group 9.

DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK	The cause of this trouble is usually in the starting system (Group 14). If the starting system is not at fault, check for a hydrostatic lock or a seized engine as follows: Remove the spark plugs, then attempt to crank the engine with the starter. If the engine cranks, it indicates that water is leaking into the cylinders. Remove the cylinder head(s) and inspect the gasket(s) and/or head(s) for cracks. Examine the cylinder block for cracks.
ENGINE CRANKS NORMALLY, BUT WILL NOT START	Check the fuel supply. If there is sufficient fuel in the tank and the proper starting procedure is used, the cause of the trouble probably lies in either the ignition or the fuel system. To determine which system is at fault, perform the following test: Disconnect a spark plug wire. Check the spark intensity at the end of the wire by installing a terminal

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)

adapter in the terminal of the wire to be checked. Then hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine.

IF THERE IS NO SPARK OR A WEAK SPARK AT THE SPARK PLUGS

The cause of the trouble is in the ignition system.

To determine if the cause of the trouble is in the primary or the secondary circuit, remove the coil high tension lead from the top of the distributor, **and hold it approximately 3/16 inch from the cylinder head.** With the ignition on, crank the engine and check for a spark.

If the spark at the coil high tension lead is good, the cause of the trouble is probably in the distributor cap, rotor or spark plug wires.

If there is no spark or a weak spark at the coil high tension lead, the cause of the trouble is probably in the primary circuit, coil to distributor high tension lead, or the coil.

IF THERE IS A GOOD SPARK AT THE SPARK PLUGS

Check the spark plugs. If the spark plugs are not at fault, check the following items:

MANUAL CHOKE

Check the choke linkage for binding or damage. Make certain the choke plate closes when the choke knob on the instrument panel is pulled out and that the plate opens when the knob is pushed in.

AUTOMATIC CHOKE

Check the position of the choke plate. If the engine is hot, the plate should be open. If the plate is not open, the engine will load up due to the excessively rich mixture and will not start. If the engine is cold, the plate should be closed. If the plate is not operating properly, check the following items:

The choke plate and linkage for binding.

The fast idle cam for binding.

Thermostatic spring housing adjustment.

FUEL SUPPLY AT THE CARBURETOR

Work the throttle by hand several times. Each time the throttle is actuated, fuel should spurt from the accelerating pump discharge port (6-cylinder) or nozzles (V-8).

If fuel is discharged by the accelerating pump, the engine is probably flooded, or there is water in the fuel system, or an engine mechanical item is at fault.

If fuel is not discharged by the accelerating pump, disconnect the carburetor fuel inlet line at the carburetor. Use a suitable container to catch the fuel. Crank the engine to see if fuel is reaching the carburetor.

If fuel is not reaching the carburetor, check:

The fuel filter.

The fuel pump.

The carburetor fuel inlet line for obstructions.

The fuel pump flexible inlet line for a collapsed condition.

The fuel tank line for obstructions.

The fuel tank vent.

If fuel is reaching the carburetor, check:

The fuel inlet system including the fuel inlet needle and seat assembly and the float assembly.

ENGINE

Mechanical failure in camshaft drive.

ENGINE STARTS, BUT FAILS TO KEEP RUNNING

FUEL SYSTEM

Idle fuel mixture needle(s) not properly adjusted.

Engine idle speed set too low.

The choke not operating properly.

Float setting incorrect.

Fuel inlet system not operating properly.

Dirt or water in the fuel lines or in the fuel filter.

Carburetor icing.

Fuel pump defective.

Check for dirt in the carburetor not allowing fuel to enter or be discharged from the idle system.

IGNITION SYSTEM

Leakage in the high tension wiring.

Open circuit in primary resistance wire.

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

ENGINE RUNS, BUT MISSES

Determine if the miss is steady or erratic and at what speed the miss occurs by operating the engine at various speeds under load.

MISSES STEADILY AT ALL SPEEDS

Isolate the miss by operating the engine with one cylinder not firing. This is done by operating the engine with the ignition wire removed from one spark plug at a time, until all cylinders have been checked. Ground the spark plug wire removed.

If the engine speed changes when a particular cylinder is shorted out, that cylinder was delivering power before being shorted out. If no change in the engine operation is evident, the miss was caused by that cylinder not delivering power before being shorted out. In this case, check the:

IGNITION SYSTEM

If the miss is isolated in a particular cylinder, perform a spark test on the ignition lead of that cylinder.

If a good spark does not occur, the trouble is in the secondary circuit of the system. Check the spark plug wire and the distributor cap.

If a good spark occurs, check the spark plug. If the spark plug is not at fault, a mechanical component of the engine is probably at fault.

ENGINE

Intake manifold gasket leak (V-8).

Perform a compression test to determine which mechanical component of the engine is at fault.

MISSES ERRATICALLY AT ALL SPEEDS

EXHAUST SYSTEM

Exhaust system restricted.

IGNITION SYSTEM

Breaker points not properly adjusted.

Defective breaker points, condenser, secondary wiring, coil or spark plugs.

High tension leakage across the coil, rotor or distributor cap.

Defective ignition switch.

FUEL SYSTEM

Float setting incorrect.

Fuel inlet system not operating properly.

Dirt or water in the fuel lines or carburetor.

Restricted fuel filter.

Loose booster venturi (V-8).

COOLING SYSTEM

Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature.

ENGINE

Perform a compression test to determine which mechanical component of the engine is at fault.

MISSES AT IDLE ONLY

FUEL SYSTEM

Idle fuel mixture needle not properly adjusted.

Restriction in idle fuel system.

IGNITION SYSTEM

Excessive play in the distributor shaft.

Worn distributor cam.

ENGINE

Valve clearance set too tight. Worn camshaft lobe(s).

Perform a compression test to determine which mechanical component of the engine is at fault.

MISSES AT HIGH SPEED ONLY

FUEL SYSTEM

Power valve or passages clogged or damaged.

Low or erratic fuel pump pressure.

Fuel inlet system not operating properly.

Restricted fuel filter.

Restricted main fuel system.

Positive crankcase ventilation system restricted or not operating properly.

COOLING SYSTEM

Engine overheating.

ENGINE

Perform a compression test to determine which mechanical component of the engine is at fault.

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

ROUGH ENGINE IDLE	**FUEL SYSTEM** Engine idle speed set too low. Idle fuel mixture needle(s) not properly adjusted. Float setting incorrect. Air leaks between the carburetor, spacer and the manifold and/or fittings. Intake manifold gasket leak (V-8). Fuel leakage at the carburetor fuel bowl. Power valve leaking fuel (V-8). Idle fuel system air bleeds or fuel passages restricted. Fuel bleeding from the accelerating pump discharge port (6-cylinder) or nozzles (V-8). Leaking fuel pump, lines or fittings. **IGNITION SYSTEM** Improperly adjusted or defective breaker points. Fouled or improperly adjusted spark plugs. Incorrect ignition timing. Spark plug misfiring. **ENGINE** Loose engine mounting bolts or worn insulator. Cylinder head bolts not properly torqued. Valve clearance set too tight. Crankcase ventilation regulator valve defective or a restricted tube.
POOR ACCELERATION	**IGNITION SYSTEM** Incorrect ignition timing. Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. Distributor not advancing properly. Loose or defective spark control valve (6-cylinder). **FUEL SYSTEM** Inoperative accelerating pump inlet ball check. Inoperative accelerating pump discharge ball check. Accelerating pump diaphragm defective. Float setting incorrect. Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted. Leaky power valve, gaskets, or accelerating pump diaphragm. Power valve piston stuck in the up position (6-cylinder). Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. Restricted fuel filter. Defective fuel pump. **BRAKES** Improper adjustment. **TRANSMISSION** Clutch slippage (manual-shift transmissions). Improper band adjustment (automatic transmissions). Converter One-Way Clutch (automatic transmissions).
ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE	**FUEL SYSTEM** Restricted air cleaner. Restricted fuel filter. Clogged or undersize main jets and/or low float setting. Power valve or passages clogged or damaged. Fuel pump pressure incorrect. Distributor vacuum passage in the carburetor blocked. Power valve piston stuck in the up position (6-cylinder). **IGNITION SYSTEM** Ignition timing not properly adjusted. Defective coil, condenser, or rotor. Distributor not advancing properly. Excessive play in the distributor shaft. Distributor cam worn. Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. **EXHAUST SYSTEM** Restriction in system. **COOLING SYSTEM** Thermostat inoperative or incorrect heat range. Thermostat installed incorrectly. Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **ENGINE** Perform an engine compression test to determine which mechanical component of the engine is at fault. One or more camshaft lobes worn beyond wear limit. Worn valve guides (V-8). **TRANSMISSION** Improper band adjustment (automatic transmissions).

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

EXCESSIVE FUEL CONSUMPTION	Determine the actual fuel consumption with test equipment installed in the car. If the test indicates that the fuel consumption is not excessive, demonstrate to the owner how improper driving habits will affect fuel consumption. If the test indicates that the fuel consumption is excessive, make a preliminary check of the following items before proceeding to the fuel and ignition systems. **PRELIMINARY CHECKS** **CHASSIS ITEMS** Check: Tires for proper pressure. Front wheel alignment. Brake adjustment. **EXHAUST SYSTEM** System restricted. **ODOMETER** Check calibration. **IGNITION SYSTEM** Check: Distributor breaker points. Ignition timing. **ENGINE** Crankcase ventilation regulator valve defective or restricted tubes (Positive Crankcase Ventilation System). **FINAL CHECKS** **FUEL SYSTEM** Check: Fuel pump pressure. Engine idle speed.	Idle fuel mixture needle(s) for proper adjustment. Automatic choke for proper operation. Fast idle speed screw for proper adjustment. Accelerating pump stroke adjustment. Anti-stall dashpot for proper adjustment. Air cleaner for restrictions. Float setting or fuel level. Jets for wear and/or damage. Power valve operation. Air bleeds for obstructions. Accelerating pump discharge port (6-cylinder) or nozzles (V-8) for siphoning. Accelerator linkage for binds. Choke adjustment. **IGNITION SYSTEM** Check: Ignition timing. Spark plug condition and adjustment. Distributor spark advance operation. Spark control valve for proper seating (6-cylinder). **ENGINE** Perform an engine compression test to determine which mechanical component of the engine is at fault. Check valve clearance adjustment. **COOLING SYSTEM** Check thermostat operation and heat range. **TRANSMISSION** Check band adjustment (automatic transmissions).
ENGINE OVERHEATS	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective (not indicating correct temperature), or constant voltage regulator defective. **ENGINE** Cylinder head bolts not properly torqued. Incorrect valve clearance. Low oil level or incorrect viscosity oil used.	**COOLING SYSTEM** Insufficient coolant. Cooling system leaks. Drive belt tension incorrect. Radiator fins obstructed. Thermostat defective. Thermostat improperly installed. Cooling system passages blocked. Water pump inoperative. **IGNITION SYSTEM** Incorrect ignition timing.

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

LOSS OF COOLANT	**COOLING SYSTEM** Leaking radiator. Loose or damaged hose connections. Water pump leaking. Radiator cap defective. Overheating. **ENGINE** Cylinder head gasket defective.	Intake manifold to cylinder head gasket defective (V-8). Cylinder head or intake manifold bolts (V-8) not properly torqued. Cylinder block core plugs leaking. Temperature sending unit leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface.
ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective (not indicating correct temperature) or constant voltage regulator defective.	**COOLING SYSTEM** Thermostat inoperative or of incorrect heat range.
NOISY HYDRAULIC VALVE LIFTER	A noisy hydraulic valve lifter can be located by operating the engine at idle speed and placing a finger on the face of the valve spring retainer. If the lifter is not functioning properly, a shock will be felt when the valve seats. Another method of identifying a noisy lifter is by the use of a piece of hose. With the engine operating at idle speed, place one end of the hose near the end of the valve stem and the other end to the ear and listen for a metallic noise. Repeat this procedure on each intake and exhaust valve until the noisy lifter(s) has been located. The most common causes of hydraulic valve lifter troubles are dirt, gum, varnish, carbon deposits and air bubbles. Dirt in the lifter assembly can prevent the disc valve from seating, or it may become lodged between the plunger and body surfaces. In either case, the lifter becomes inoperative due to failure to "pump-up," or because the internal parts are no longer free to function properly. When dirt is found to be responsible for lifter malfunction, remove the lifter assembly and thoroughly clean it. Recommended engine oil and filter change intervals should be followed to minimize lifter problems caused by dirt (Group 19). Deposits of gum and varnish cause similar conditions to exist which may result in lifter malfunction. If these conditions are found to be present, the lifter should be disassembled and cleaned in solvent to remove all traces of deposits.	Air bubbles in the lubricating oil, caused by an excessively high or low oil level, may likewise cause lifter malfunction. A damaged oil pick-up tube may allow air to be drawn into the lubricating system. Check for engine oil aeration as follows: Check the engine oil level to be sure it is within specification and correct as required. **Be sure the correct engine oil dipstick is being used.** Operate the engine at approximately 1200 rpm until normal operating temperature is reached. Stop the engine and remove the oil pressure sending unit. Install a fitting in this opening with a petcock-type valve that will permit attachment of a ¼ to ⅜-inch diameter hose of sufficient length to direct the oil discharge into the oil filler pipe. Close the valve. Start the engine and operate it at approximately 500 rpm for a minimum of 5 minutes; then, open the valve slightly to permit a steady discharge of oil. Check the oil flow. Increase the engine speed to approximately 1000 rpm and check for air bubbles in the oil. **To facilitate checking for air bubbles, direct the oil flow over white paper or through a piece of transparent tube. The engine should not be operated at excessive speeds or for extended periods with the oil bleed attached.** If oil aeration is evident, remove the oil pan for further test and/or inspection of the oil pump intake system. Perform corrective action as required to remove air from the lubricating oil.

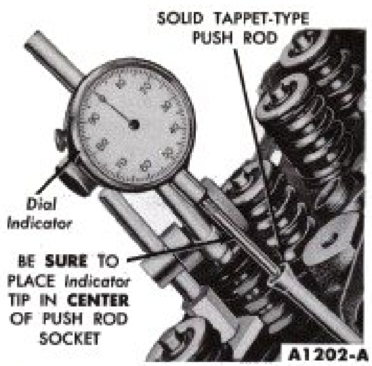


FIG. 1—Camshaft Lobe Lift—144, 170 and 200 Six

TESTING

CAMSHAFT LOBE LIFT

1. Remove the air cleaner and the valve rocker arm cover(s).

2. Remove the valve rocker arm shaft assembly and install a solid tappet-type push rod in the push rod bore of the camshaft lobe to be checked.

Make sure the push rod is in the tappet socket or the lifter push rod cup. Install a dial indicator in such a manner as to have the actuating point of the indicator in the push rod socket and in the same plane as the push rod movement (Fig. 1).

3. On a 260 or 289 V-8 with ball stud rocker arms, remove the rocker arm stud nut, fulcrum seat and rocker arm.

Make sure the push rod is in the lifter cup. Install a dial indicator in such a manner as to have the ball socket adapter of the indicator on the end of the push rod and in the same plane as the push rod movement (Fig. 2).

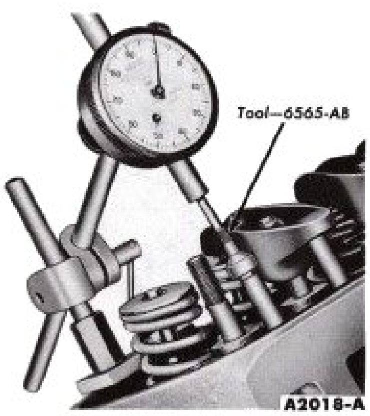


FIG. 2—Camshaft Lobe Lift—260 and 289 V-8

4. Install an auxiliary starter switch. "Bump" the crankshaft over until the lifter is on the base circle of the camshaft lobe. At this point, the push rod will be in its lowest position.

5. Zero the dial indicator. Continue to rotate the crankshaft slowly until the push rod is in the fully raised position.

6. Compare the total lift recorded on the indicator with specifications.

7. To check the accuracy of the original indicator reading, continue to rotate the crankshaft until the indicator reads zero.

8. Remove the dial indicator.

9. Install the valve rocker arm shaft.

10. On a 260 or 289 V-8 with ball stud rocker arms, install the rocker arm, fulcrum seat and stud nut. Adjust the valve clearance (Section 2).

11. Install the valve rocker arm cover(s) and the air cleaner.

COMPRESSION TEST

1. Be sure the crankcase oil is at the proper level. Be sure the battery is fully charged. Operate the engine for a minimum of 30 minutes at 1200 rpm or until the engine is at normal operating temperature. Turn the ignition switch off, then remove all the spark plugs. Remove the coil high tension lead from the distributor cap and coil.

2. Set the throttle plates (primary throttle plates only on a 4-barrel carburetor) and choke plate in the wide open position.

3. Install a compression gauge in No. 1 cylinder.

4. Using an auxiliary starter switch, crank the engine a minimum of five pumping strokes, and record the highest reading. Note the number of compression strokes required to obtain the highest reading.

5. Repeat the test on each cylinder, cranking the engine the same number of times for each cylinder as was required to obtain the highest reading on the No. 1 cylinder.

Test Conclusions. A variation of ± 20 psi from specified pressure is satisfactory. However, the compression of all cylinders should be uniform within 10 psi.

A reading of more than the allowable tolerance above normal indicates excessive deposits in the cylinder or wrong cylinder head(s) on the engine.

A reading of more than the allowable tolerance below normal indicates leakage at the cylinder head gasket, piston rings or valves or wrong cylinder head(s) on the engine.

A low, even compression in two adjacent cylinders indicates a cylinder head gasket leak. This should be checked before condemning the rings or valves.

To determine whether the rings or the valves are at fault, squirt the equivalent of a tablespoon of heavy oil into the combustion chamber. Crank the engine to distribute the oil and repeat the compression test. The oil will temporarily seal leakage past the rings. If approximately the same reading is obtained, the rings are satisfactory, but the valves are leaking. If the compression has increased 10 pounds or more over the original reading, there is leakage past the rings.

During a compression test, if the pressure fails to climb steadily and remains the same during the first two successive strokes, but climbs higher on the succeeding strokes, or fails to climb during the entire test, it indicates a sticking valve.

MANIFOLD VACUUM TEST

A manifold vacuum test aids in determining the condition of an engine and also in helping to locate the cause of poor engine performance. To check manifold vacuum:

1. Operate the engine for a minimum of 30 minutes at 1200 rpm.

2. On 6-cylinder engines, install an accurate, sensitive vacuum gauge in the intake manifold fitting.

On a V-8 engine, remove the plug or power brake line at the rear of the intake manifold and install an accurate, sensitive vacuum gauge.

3. Operate the engine at recommended idle rpm, with the transmission selector lever in neutral.

4. Check the vacuum reading on the gauge.

Test Conclusions. Manifold vacuum is affected by carburetor adjustment, valve timing, ignition timing, the condition of the valves, cylinder compression, the condition of the crankcase ventilation system, and leakage of the manifold, carburetor, carburetor spacer or cylinder head gaskets.

TABLE 1—Manifold Vacuum Gauge Readings

Gauge Reading	Engine Condition
18 inches or over—All engines.	Normal.
Low and steady.	Loss of power in all cylinders caused possibly by late ignition or valve timing, or loss of compression due to leakage around the piston rings.
Very low.	Manifold, carburetor, spacer or cylinder head gasket leak.
Needle fluctuates steadily as speed increases.	A partial or complete loss of power in one or more cylinders caused by a leaking valve, cylinder head or intake manifold gasket leak, a defect in the ignition system or a weak valve spring.
Gradual drop in reading at engine idle.	Excessive back pressure in the exhaust system.
Intermittent fluctuation.	An occasional loss of power possibly caused by a defect in the ignition system or a sticking valve.
Slow fluctuation or drifting of the needle.	Improper idle mixture adjustment or carburetor, spacer or intake manifold gasket leak or malfunctioning crankcase ventilation system.

Because abnormal gauge readings may indicate that more than one of the above factors are at fault, exercise caution in analyzing an abnormal reading. For example, if the vacuum is low, the correction of one item may increase the vacuum enough so as to indicate that the trouble has been corrected. It is important, therefore, that each cause of an abnormal reading be investigated and further tests conducted, where necessary, in order to arrive at the correct diagnosis of the trouble.

Table 1 lists various types of readings and their possible causes.

Allowance should be made for the effect of altitude on the gauge reading. The engine vacuum will decrease with an increase in altitude.

POSITIVE CRANKCASE VENTILATION SYSTEM TEST

A malfunctioning positive crankcase ventilation system may be indicated by loping or rough engine idle. Do not attempt to compensate for this idle condition by disconnecting the crankcase ventilation system and making carburetor adjustments. The removal of the crankcase ventilation system from the engine will adversely affect the fuel economy and engine ventilation with resultant shortening of engine life.

To determine whether the loping or rough engine idle condition is caused by a malfunctioning crankcase ventilation system, assemble a service tool from a known good regulator valve and install it in the ventilation system as follows:

1. Disassemble a known good regulator valve. Note that the spring normally holds the conical valve spool away from the valve seat in the regulator valve body (Fig. 3). The valve spool is correctly installed in the valve body when the conical end of the spool is pointing in the same direction as the flow arrow on the valve body.

Assemble the regulator valve with the spring between the valve spool and connector to keep the spool seated in the body. This ensures a restricted flow through the regulator valve which is the normal valve function during engine operation at idle speeds.

Identify the service tool as such by painting the engine cubic inch displacement figure on the valve body.

When the regulator valve has been assembled as a service tool, the calibration of the spring may change; therefore the service tool or its parts should not be used as replacement parts.

2. Disconnect the hose at the regulator valve end and leave the opposite end attached to the intake manifold.

3. Attach the service valve tool to the hose which leads to the intake manifold. **Leave the opposite end of the valve vented to the atmosphere.**

4. Be sure the crankcase ventilation tube (or hose) fitting at the intake manifold or carburetor spacer (whichever is applicable) is open.

A clogged orifice in the carburetor spacer or intake manifold will

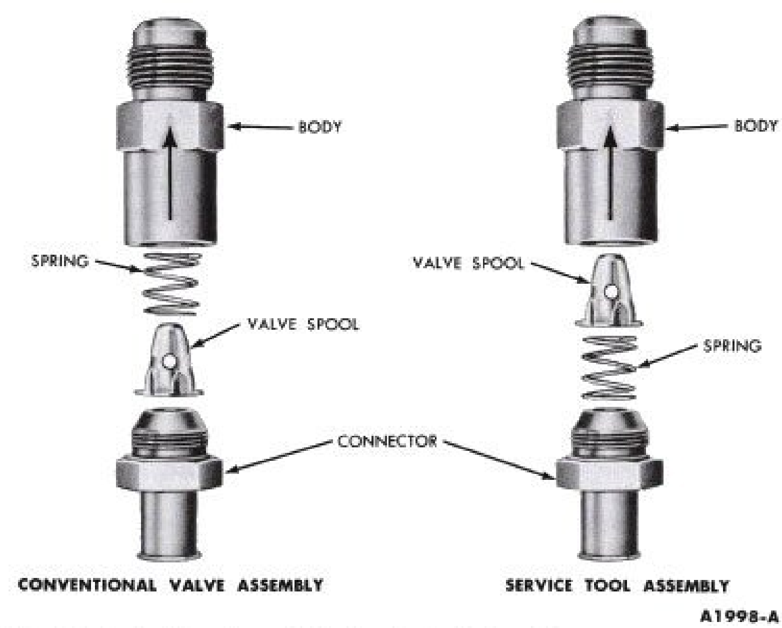


FIG. 3—Typical Regulator Valve Service Tool Assembly

cause the ventilation system to malfunction.

5. Start the engine and compare the engine idle condition to the prior idle condition.

If the loping or rough idle condition remains when the regulator valve tool is installed, the crankcase ventilation system is not at fault. Further engine component diagnosis will have to be conducted to find the malfunction.

If the idle condition is found to be satisfactory, refer to Section 3 for the cleaning and inspection procedures.

HYDRAULIC VALVE LIFTER TESTS

Dirt, deposits of gum and varnish and air bubbles in the lubricating oil can cause hydraulic valve lifter failure or malfunction.

Dirt, gum and varnish can keep a check valve from seating and cause a loss of hydraulic pressure. An open valve disc will cause the plunger to force oil back into the valve lifter reservoir during the time the push rod is being lifted to force the valve from its seat.

Air bubbles in the lubricating system can be caused by too much oil in the system or too low an oil level. Air may also be drawn into the lubricating system through an opening in a damaged oil pick-up tube. **Air in the hydraulic system can cause a loss of hydraulic pressure in the valve lifter.**

Assembled valve lifters can be tested with tool 6500-E to check the leak down rate. The leak down rate specification (for gauging purposes) is 10-100 seconds at 50 lbs. load. Plunger travel is 0.125 inch. Test the valve lifters as follows:

1. Place the valve lifter in the tester, with the plunger facing upward. Pour hydraulic tester fluid into the cup to a level that will cover the valve lifter assembly. **The fluid can be purchased from the manufacturer of the tester. Do not use kerosene, for it will not provide an accurate test.**

2. Place a 5⁄16-inch steel ball in the plunger cup (Fig. 4).

3. Adjust the length of the ram so that the pointer is in line with the starting mark when the ram contacts the valve lifter plunger (Fig. 5).

4. Work the valve lifter plunger up and down until the lifter fills with fluid and all traces of air bubbles has disappeared (Fig. 6).

5. Allow the ram and weight to force the valve lifter plunger downward. Measure the exact time it takes for the pointer to travel from the "Start Timing" to the "Stop Timing" marks of the tester (Fig. 7).

6. A valve lifter that is satisfactory must take at least 10 seconds, but not more than 100 seconds, to leak down.

7. If the valve lifter is not within specifications, disassemble the lifter and clean and inspect it as outlined in Section 3. Assemble the lifter and test the lifter again. If it does not meet specifications, replace it with a new lifter. **Always test a new lifter before installing it in the engine.**

8. Remove the fluid from the cup and bleed the fluid from the lifter by depressing the plunger up and down (Fig. 6). **This step will aid in depressing the lifter plungers when checking the valve clearance.**

CRANKSHAFT END PLAY

1. Force the crankshaft toward the rear of the engine.

2. Install a dial indicator so that the contact point rests against the crankshaft flange and the indicator axis is parallel to the crankshaft axis (Fig. 8).

3. Zero the dial indicator. Push

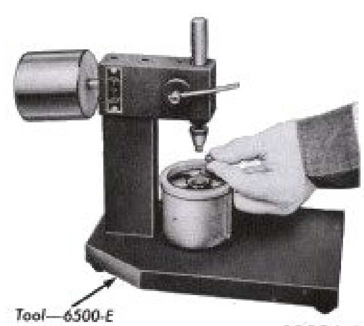


FIG. 4—Placing Steel Ball in Valve Lifter Plunger

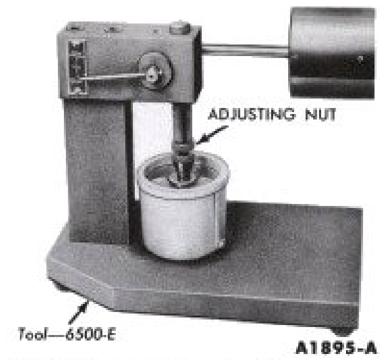


FIG. 5—Adjusting the Ram Length

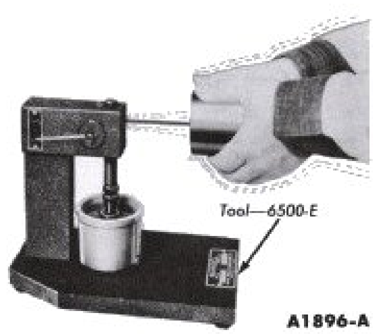


FIG. 6—Operate Plunger Until Air Bubbles Disappear

FIG. 7—Checking Leak Down Rate

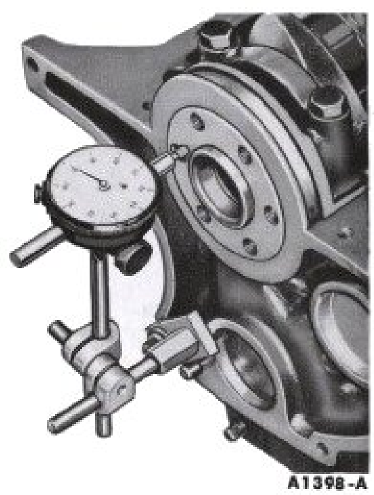


FIG. 8—Typical Crankshaft End Play

FIG. 9—Typical Flywheel Face Runout

the crankshaft forward and note the reading on the dial.

4. If the end play exceeds the wear limit (0.012 inch), replace the thrust bearing. If the end play is less than the minimum limit, inspect the thrust bearing faces for scratches, burrs, nicks, or dirt. If the thrust faces are not defective or dirty, they probably were not aligned properly. Install the thrust bearing and align the faces following the procedure recommended under "Main Bearing Replacements" in the pertinent engine section. Check the crankshaft end play.

FLYWHEEL FACE RUNOUT—MANUAL-SHIFT TRANSMISSIONS

Install a dial indicator so that the indicator point bears against the flywheel face (Fig. 9). Turn the flywheel making sure that it is full forward or rearward so that crankshaft end play will not be indicated as flywheel runout.

If the clutch face runout exceeds the specifications, remove the flywheel and check for burrs between the flywheel and the face of the crankshaft mounting flange. If no burrs exist, check the runout of the crankshaft mounting flange. Replace the flywheel or machine the crankshaft flywheel mounting face if the mounting flange runout is excessive.

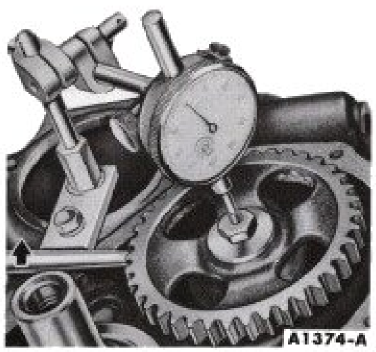


FIG. 10—Typical Camshaft End Play

If the ring gear runout exceeds specifications, replace it or reinstall it on the flywheel.

CAMSHAFT END PLAY

Push the camshaft toward the rear of the engine. Install a dial indicator so that the indicator point is on the camshaft sprocket cap screw (Fig. 10). Zero the dial indicator. Position a large screw driver between the camshaft sprocket and the block. Pull the camshaft forward and release it. Compare the dial indicator reading with specifications. If the end play is excessive, replace the thrust plate. Remove the dial indicator.

TIMING CHAIN DEFLECTION

1. Rotate the crankshaft in a clockwise direction (as viewed from the front) to take up the slack on the left side of the chain.

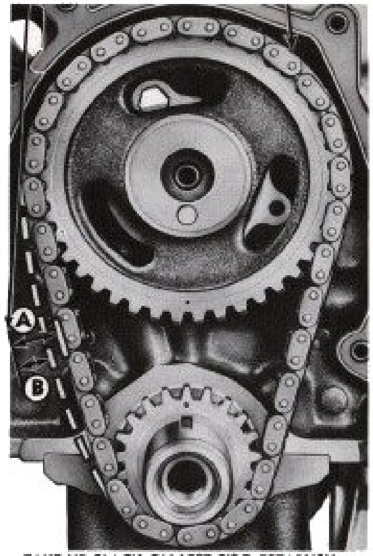


FIG. 11—Typical Timing Chain Deflection

2. Establish a reference point on the block and measure from this point to the chain (Fig. 11).

3. Rotate the crankshaft in the opposite direction to take up the slack on the right side of the chain. Force the left side of the chain out with the fingers and measure the distance between the reference point and the chain. The deflection is the difference between the two measurements.

If the deflection exceeds specifications, replace the timing chain and sprockets.

2 COMMON ADJUSTMENTS AND REPAIRS

ADJUSTMENTS

VALVE CLEARANCE—144, 170 AND 200 SIX

The valve clearance may be adjusted by either of the following methods.

Lifter Extended Method.

1. Make two chalk marks on the crankshaft pulley or damper (Fig. 12). Space the marks approximately 120° apart so that with the timing mark, the pulley or damper is divided into three equal parts (120° represents ⅓ of the distance around the pulley or damper circumference).

2. Using an auxiliary starter switch, rotate the crankshaft until No. 1 piston is approximately at T.D.C. at the end of the compression stroke. Adjust the No. 1 cylinder intake and exhaust valve lash. Back off the adjusting screw until there is definite clearance between the rocker arm and valve stem. Turn the rocker arm adjusting screw clockwise (tighten) to remove all the push rod to rocker arm end clearance. This may be determined by rotating and/or moving the push rod with the fingers as the adjusting screw is tightened.

3. When all the push rod end clearance has been eliminated, tighten the adjusting screw an additional 2½ turns to place the hydraulic lifter plunger at the approximate center

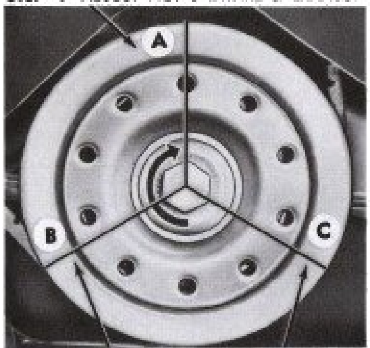


FIG. 12—Preliminary Valve Clearance Adjustment

of its travel. **If the torque required to turn the self-locking adjusting screw is less than 7 ft-lbs, install a new, oversize adjusting screw. If unable to obtain a minimum torque of 7 ft-lbs with the oversize adjusting screw, replace the rocker arm and adjusting screw assembly.**

4. Repeat this procedure (steps 2 and 3) for the remaining sets of valves, positioning each piston at approximately T.D.C. in the firing order sequence by turning the crankshaft ⅛ turn at a time in the direction of rotation. **The engine should not be cranked or rotated until the hydraulic lifters have had an opportunity to leak down to their normal operating positions or a bent valve may result. The leak-down rate may be accelerated by applying pressure on the push rod end of the rocker arm using Tool T58P-6565-A.**

Lifter Collapsed Method

1. Follow steps 2 and 3 of the "Lifter Extended Method."

2. Using tool T58P-6565-A, apply pressure to the push rod end of the rocker arm to slowly bleed down the valve lifter until the plunger is completely bottomed. Hold the lifter in this position and check the available clearance between the rocker arm and valve stem tip.

If clearance is not within specifications, turn the adjusting screw clockwise to decrease or counterclockwise to increase the clearance.

FIG. 13—Valve Clearance Adjustment

Normally, one turn of the adjusting screw will alter the clearance by 0.075 inch at the valve stem tip.

VALVE CLEARANCE—260 AND 289 V-8

1. Position the crankshaft as outlined in steps 2 and 3. Loosen the rocker arm stud nut until there is end clearance in the push rod, then tighten the nut to just remove all the push rod to rocker arm end clearance. This may be determined by rotating and/or moving the push rod with the fingers as the stud nut is tightened (Fig. 13). When the push rod end clearance has been eliminated, tighten the stud nut an additional 2 turns to place the hydraulic lifter plunger in the center of its travel.

2. Using an auxiliary starter switch, rotate the crankshaft until No. 1 piston is on TDC at the end of the compression stroke. With No. 1 piston on TDC, adjust the following valves:

No. 2 Exhaust	No. 1 Intake
No. 5 Exhaust	No. 1 Exhaust
No. 7 Intake	No. 3 Intake
No. 8 Intake	No. 4 Exhaust

3. After these valves have been adjusted, rotate the crankshaft 360° (one revolution) to position No. 6 piston on TDC and adjust the following valves:

No. 2 Intake	No. 6 Intake
No. 3 Exhaust	No. 6 Exhaust
No. 4 Intake	No. 7 Exhaust
No. 5 Intake	No. 8 Exhaust

The engine should not be cranked or rotated until the hydraulic lifters have had an opportunity to leak down to their normal operating position. The leak-down rate can be accelerated by pressing down on the push rod end of the rocker arm.

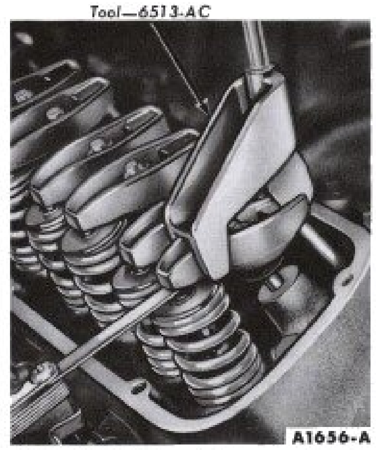


FIG. 14—Valve Clearance Check

The valves can also be adjusted by positioning each piston on TDC at the end of the compression stroke in the firing order sequence.

4. Operate the engine and check for rough engine idle or a noisy lifter(s). Valve clearance set too tight will cause rough engine idle and valve clearance set too loose will cause a noisy lifter(s). If it has been determined that these conditions are caused by improper valve clearance, adjust the affected valve(s) using the following procedure:

Follow steps 2 and 3 in the above procedure. Apply pressure to slowly bleed down the valve lifter until the plunger is completely bottomed (Fig. 14). While holding the valve lifter in the fully collapsed position, check the available clearance between the rocker arm and valve stem tip (Fig. 14). If the clearance is not within specifications, rotate the rocker arm stud nut "clockwise" to decrease the clearance and "counterclockwise" to increase the clearance. **Normally one turn of the rocker arm stud nut will vary the clearance by 0.066 inch.**

REPAIRS

VALVE ROCKER ARM AND/OR SHAFT ASSEMBLY

Dress up minor surface defects on the rocker arm shaft and in the rocker arm bore with a hone.

If the pad at the valve end of the rocker arm has a grooved radius, replace the rocker arm. **Do not attempt to true this surface by grinding.**

For a 260 or 289 V-8 engine, refer to "Cylinder Head Repair" for the rocker arm stud replacement procedure.

PUSH RODS

Following the procedures in Section 3. under "Push Rod Inspection," check the push rods for straightness.

If the runout exceeds the maximum limit at any point, discard the rod. **Do not attempt to straighten push rods.**

CYLINDER HEADS

Replace the head if it is cracked. **Do not plane or grind more than 0.010 inch from the cylinder head gasket surface.** Remove all burrs or scratches with an oil stone.

Rocker Arm Stud Replacement—260 and 289 V-8. If it is necessary to remove a rocker arm stud, a rocker arm stud kit (tool T62F-6A527-A) is available which contains the following: a stud remover, a 0.006-inch O.S. reamer, a 0.015-inch O.S. reamer and a stud installer.

Rocker arm studs that are broken or have damaged threads may be replaced with standard studs. Loose studs in the head may be replaced with 0.006 or 0.015-inch oversize studs which are available for service. The standard studs have no identification markings, whereas the 0.006-inch oversize stud has two grooves around the pilot end of the stud and the 0.015 inch oversize stud has a step produced by the increased diameter of the stud approximately 1⁹⁄₃₂ inches from the pilot end.

When going from a standard size rocker arm stud to a 0.015-inch oversize stud, always use the 0.006-inch reamer before finish reaming with the 0.015-inch reamer.

FIG. 15—Rocker Arm Stud Removal

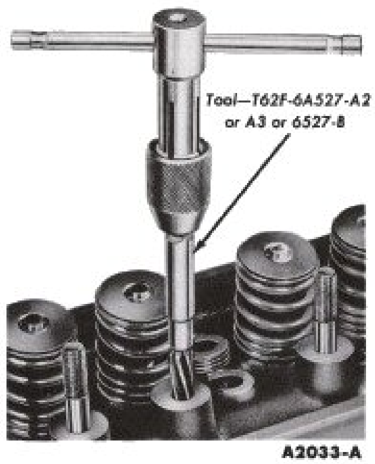


FIG. 16—Reaming Rocker Arm Stud Bore

1. Position the sleeve of the rocker arm stud remover (tool T62F-6A527-A1) over the stud with the bearing end down. Thread the puller into the sleeve and over the stud until it is fully bottomed. Hold the sleeve with a wrench, then rotate the puller clockwise to remove the stud (Fig. 15).

If the rocker arm stud was broken off flush with the stud boss, use an easy-out to remove the broken stud following the instructions of the tool manufacturer.

2. If a loose rocker arm stud is being replaced, ream the stud bore using the proper reamer (or reamers in sequence) for the selected oversize stud (Fig. 16). **Make sure the metal particles do not enter the valve area.**

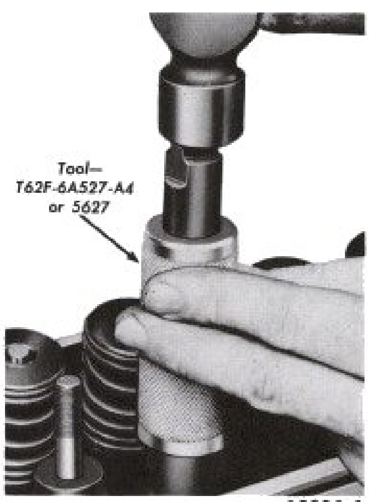


FIG. 17—Rocker Arm Stud Installation

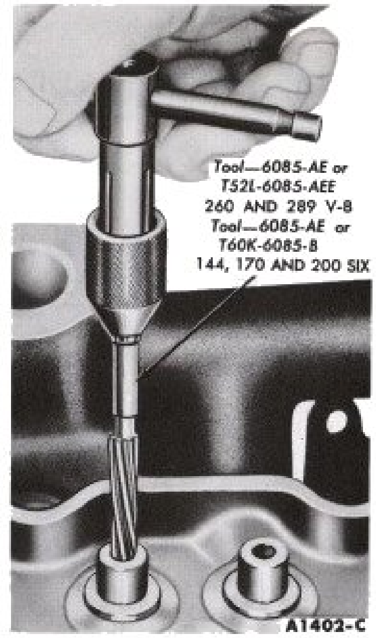


FIG. 18—Reaming Valve Guides

3. Screw the new stud into the sliding driver of the rocker arm stud installer (tool T62F-6A527-A4) and coat the end of the stud with Lubriplate. Align the stud and installer with the stud bore, then tap the sliding driver until it bottoms (Fig. 17). When the installer contacts the stud boss, the stud is installed to its correct height.

Reaming Valve Guides. If it becomes necessary to ream a valve guide (Fig. 18) to install a valve with an oversize stem, a reaming kit is available which contains the following reamer and pilot combinations: a 0.003-inch O.S. reamer with a standard diameter pilot, a 0.015-inch O.S. reamer with a 0.003-inch O.S. pilot, and a 0.030-inch reamer with a 0.015-inch O.S. pilot.

When going from a standard size valve to an oversize valve, always use the reamers in sequence. **Always reface the valve seat after the valve guide has been reamed.**

Refacing Valve Seats. Refacing of the valve seats should be closely coordinated with refacing of the valve face so that the finished seat will match the valve face and be centered. This is important so that the valve and seat will have a good compression-tight fit. Be sure that the refacer grinding wheels are properly dressed.

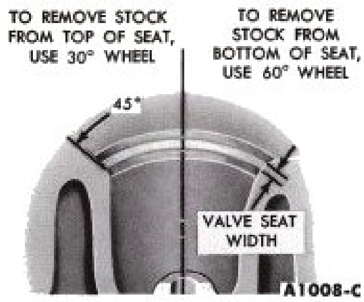


FIG. 19—Valve Seat Refacing

Grind the valve seats to a true 45° angle (Fig. 19). Remove only enough stock to clean up pits, grooves, or to correct the valve seat runout. After the seat has been refaced, use a seat width scale to measure the seat width (Fig. 20). Narrow the seat, if necessary to bring it within specifications.

If the valve seat width exceeds the maximum limit, remove enough stock from the top edge and/or bottom edge of the seat to reduce the width to specifications (Fig. 19).

Use a 30° angle grinding wheel to remove stock from the top of the seats (lower the seats) and use a 60° angle wheel to remove stock from the bottom of the seats (raise the seats).

The finished valve seat should contact the approximate center of the valve face. It is good practice to determine where the valve seat contacts the face. To do this, coat the seat with Prussian blue, then set the valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of the valve face, the contact is satisfactory. If the blue is transferred to the top edge of the valve face, lower the valve seat. If the blue is transferred to the bottom edge of the valve face, raise the valve seat.

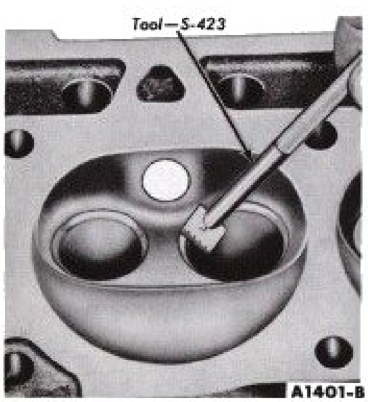


FIG. 20—Valve Seat Width

VALVES

Valve defects, such as minor pits, grooves, etc. may be removed. Discard valves that are severely damaged, or if the face runout or stem clearance exceed specifications.

Discard any defective part of the valve assembly.

Refacing Valves. The valve refacing operation should be closely coordinated with the valve seat refacing operation so that the finished angles of the valve face and of the valve seat will provide a compression-tight fit. Be sure that the refacer grinding wheels are properly dressed.

If the valve face runout is excessive and/or to remove pits and grooves, reface the valves to a true 44° angle. Remove only enough stock to correct the runout or to clean up the pits and grooves. If the edge of the valve head is less than 1/32 inch after grinding, replace the valve as the valve will run too hot in the engine. **The interference fit of the valve and seat should not be lapped out.**

Remove all grooves or score marks from the end of the valve stem, and chamfer it as necessary. Do not remove more than 0.010 inch from the stem.

If the valve and/or valve seat has been refaced, it will be necessary to check the clearance between the rocker arm pad and the valve stem with the valve train assembly installed in the engine.

Select Fitting Valves. If the valve stem to valve guide clearance exceeds the wear limit, ream the valve guide for the next oversize valve stem. Valves with oversize stem diameters of 0.003, 0.015, and 0.030 inch are available for service. **Always reface the valve seat after the valve guide has been reamed.** Refer to "Reaming Valve Guides."

CAMSHAFT

Remove light scuffs, scores, or nicks from the camshaft machined surfaces with a smooth oil stone.

CRANKSHAFT

Dress minor imperfections with an oil stone. If the journals are severely marred or exceed the wear limit, they should be refinished to size for the next undersize bearing.

Refinishing Journals. Refinish the journal to give the proper clearance with the next undersize bearing. If the journal will not "clean up" to give the proper clearance with the maximum undersize bearing available, replace the crankshaft.

Always reproduce the same journal shoulder radius that existed originally. Too small a radius will result in fatigue failure of the crankshaft. Too large a radius will result in bearing failure due to radius ride of the bearing.

After refinishing the journals, chamfer the oil holes, then polish the journal with a No. 320 grit polishing cloth and engine oil. Crocus cloth may be used also as a polishing agent.

PISTONS, PINS AND RINGS

Fitting Pistons. Pistons are available for service in standard sizes and the oversizes shown in Table 2.

Refer to the specifications for the piston to cylinder bore clearance. Check the clearance.

If the clearance is greater than the maximum limit, recheck calculations to be sure that the proper size piston has been selected, check for a damaged piston, then try a new piston.

If the clearance is less than the minimum limit, recheck calculations before trying another piston. If none can be fitted, refinish the cylinder for the next size piston.

When a piston has been fitted,

TABLE 2—Oversize Service Pistons

ENGINE	PISTON OVERSIZE (inches)
144 and 170 Six	0.020, 0.030, 0.040, 0.060
200 Six	0.020, 0.030, 0.040
260 V-8	0.020, 0.030, 0.040, 0.060
289 V-8 (2-V)	0.020, 0.030, 0.040
(4-V)	Standard Only

PISTON CLEARANCE							
RIBBON 0.0015 THICK & 0.500 WIDE		RIBBON 0.002 THICK & 0.500 WIDE		RIBBON 0.0035 THICK & 0.500 WIDE		RIBBON 0.006 THICK & 0.500 WIDE	
Ribbon Pull Lbs.	Clear-ance Inches	Ribbon Pull Lbs.	Clear-ance Inches	Ribbon Pull Lbs.	Clear-ance Inches	Ribbon Pull Lbs.	Clear-ance Inches
13	—	13	—	13	0.0012	13	0.0038
12	—	12	—	12	0.0014	12	0.0040
11	—	11	—	11	0.0016	11	0.0041
10	—	10	—	10	0.0018	10	0.0043
9	—	9	0.0002	9	0.0021	9	0.0045
8	—	8	0.0005	8	0.0023	8	0.0047
7	0.0002	7	0.0007	7	0.0025	7	0.0049
6	0.0004	6	0.0010	6	0.0027	6	0.0050
5	0.0007	5	0.0012	5	0.0030	5	0.0057
4	0.0009	4	0.0015	4	0.0032	4	0.0059
3	0.0012	3	0.0017	3	0.0033	3	0.0060
2	0.0015	2	0.0020	2	0.0036	2	0.0062
1	0.0017	1	0.0022	1	0.0038	1	0.0063
0	0.0020	0	0.0025	0	0.0040	0	0.0065

A1930-A

FIG. 21—Piston Clearance Chart

mark it for assembly in the cylinder to which it was fitted.

If the taper and out-of-round conditions of the cylinder bore are within limits, new piston rings will give satisfactory service provided the piston clearance in the cylinder bore is within limits. If the new rings are to be installed in a used cylinder that has not been refinished, remove the cylinder wall "glaze".

To fit a piston:

1. Calculate the size piston to be used by taking a cylinder bore check. Follow the procedures outlined in Section 3.

2. Select the proper size piston to provide the desired clearance.

3. Make sure the piston and cylinder block are at room temperature (70°F). **After any refinishing operation, allow the cylinder bore to cool and make sure the piston and bore are clean and dry before the piston fit is checked.**

4. Attach a tension scale to the end of a feeler gauge ribbon that is free of dents or burrs. The feeler ribbon should be ½-inch wide and of one of the recommended thicknesses shown in Fig. 21.

5. Position the ribbon in the cylinder bore so that it extends the entire length of the piston at 90° from the piston pin location.

6. Invert the piston and install it in the bore so that the end of the piston is about 1½ inches below the top of the cylinder block and the piston pin is parallel to the crankshaft axis.

When checking the piston to bore clearance, the ribbon and piston fit in the bore must be snug in order to obtain an accurate reading. It is necessary to support the weight of the piston with one hand to prevent twisting the piston in the bore and obtaining an erroneous reading. A used piston must always be checked in the bore from which it was removed.

7. Hold the piston and slowly pull the scale in a straight line with the ribbon, noting the pull required to remove the feeler ribbon (Fig. 22).

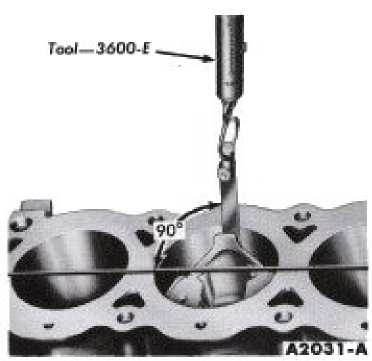


FIG. 22—Checking Piston Clearance

8. Knowing the ribbon thickness and the actual pull required, the piston clearance can be determined by referring to Fig. 21.

Example. If a 5 pound pull on the scale is required with a 0.002 inch ribbon, then the clearance between the piston and cylinder bore is 0.0012 inch.

9. If the reading on the scale is greater than the pull shown in Fig. 21, check the piston for any damage that may effect the pull reading. If no damage is evident, try another piston. Check the fit of the new piston.

Each piston thus fitted should immediately be marked with the respective cylinder number.

It is recommended that the clearance between the fitted piston and cylinder wall be held to the mean limit. The minimum and maximum clearances shown in the specifications pertain only to the fitting of a new piston in a new bore. The wear limit specification is only to be used as an allowable limit when fitting a used piston in a used bore.

Fitting Piston Rings

1. Select the proper ring set for the size piston to be used.

2. Position the ring in the cylinder bore in which it is going to be used.

3. Push the ring down into the bore area where normal ring wear is not encountered.

4. Use the head of a piston to position the ring in the bore so that the ring is square with the cylinder wall. **Use caution to avoid damage to the ring or cylinder bore.**

5. Measure the gap between the ends of the ring with a feeler gauge (Fig. 23). If the ring gap is less than the recommended lower limit, try another ring set.

6. Check the ring side clearance of the compression rings with a

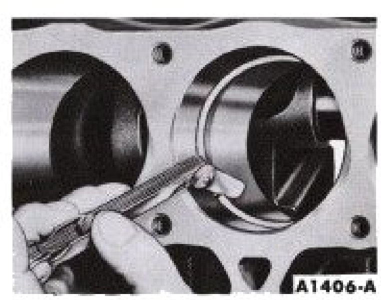


FIG. 23—Piston Ring Gap

FIG. 24—Ring Side Clearance

feeler gauge inserted between the ring and its lower land (Fig. 24). The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. **If the lower lands have high steps, the piston should be replaced.**

Fitting Piston Pins. The piston pin to piston should be a light thumb press fit at normal temperature (70°F). Refer to the specifications for the piston pin dimension.

The piston pin is an interference fit in the connecting rod. Oversize piston pins are not recommended. Refer to the specifications for the piston pin and connecting rod pin bore dimensions.

CYLINDER BLOCK

Refinishing Cylinder Walls. Honing is recommended for refinishing cylinder walls only when the walls have minor imperfections, such as light scuffs and scratches or for fitting pistons to the specified clearance. The grade of hone to be used is determined by the amount of metal to be removed. Follow the instructions of the hone manufacturer. If coarse stones are used to start the honing operation, leave enough material so that all hone marks can be removed with the finishing hone which is used to obtain the proper piston clearance.

Cylinder walls that are severely marred and/or worn beyond the specified limits should be refinished. Before any cylinder is refinished, all main bearing caps must be in place and tightened to the proper torque so that the crankshaft bearing bores will not become distorted from the refinishing operation.

Refinish only the cylinder or cylinders that require it. **All pistons are the same weight, both standard and oversize; therefore, various sizes of pistons can be used without upsetting engine balance.**

Refinish the cylinder with the most wear first to determine the maximum oversize. If the cylinder will not clean up when refinished for the maximum oversize piston recommended, replace the block.

Refinish the cylinder to within approximately 0.0015 inch of the required oversize diameter. This will allow enough stock for the final step of honing so that the correct surface finish and pattern are obtained. Use clean sharp hones of No. 220-280 grit for this operation.

For the proper use of the refinishing equipment, follow the instructions of the manufacturer. Only experienced personnel should be allowed to perform this work.

After the final operation in either of the two refinishing methods described and prior to checking the piston fit, thoroughly wash the cylinder walls with solvent to remove all abrasive particles; then thoroughly dry the walls. Check the piston fit. Mark the pistons to correspond to the cylinders in which they are to be installed. When the refinishing of all cylinders that require it has been completed and all pistons are fitted, thoroughly clean the entire block to remove all particles from the bearing bores, oil passages, cylinder head bolt holes, etc. Coat the cylinder walls with oil.

3 CLEANING AND INSPECTION

INTAKE MANIFOLD

CLEANING

Remove all gasket material from the machined surfaces of the manifold. Clean the manifold in a suitable solvent and dry it with compressed air.

INSPECTION

Inspect the manifold for cracks, damaged gasket surfaces, or other defects that would make it unfit for further service. Replace all studs that are stripped or otherwise damaged. **Remove all filings and foreign matter that may have entered the manifold as a result of repairs.**

EXHAUST MANIFOLDS

CLEANING

Remove all gasket material from the manifolds. Make sure the automatic choke air inlet and outlet holes (right exhaust manifold on V-8 engines) are completely open and the cover does not leak.

Blow out the automatic choke air heat tube with compressed air.

INSPECTION

Inspect the manifold(s) for cracks, damaged gasket surfaces, or other defects that would make them unfit for further service.

VALVE ROCKER ARM AND/OR SHAFT ASSEMBLY

CLEANING

Clean all the parts thoroughly. Make sure all oil passages are open.

On ball stud rocker arms, make sure the oil passage in the push rod end of the rocker arm is open.

INSPECTION

On rocker arm shaft assemblies, check the clearance between each rocker arm and the shaft by checking the ID of the rocker arm bore and the OD of the shaft. If the clearance between any rocker arm and the shaft exceeds the wear limit, replace the shaft and/or the rocker arm. Inspect the shaft and the rocker arm bore for nicks, scratches, scores, or scuffs.

Inspect the pad at the valve end of the rocker arm for indications of scuffing or abnormal wear. If the pad is grooved, replace the rocker arm. **Do not attempt to true this surface by grinding.**

On ball stud rocker arms, check the rocker arm and fulcrum seat for excessive wear, cracks, nicks or burrs. Check the rocker arm stud and nut for stripped or broken threads.

PUSH RODS

CLEANING

On a 260 V-8 or 289 V-8, clean the push rods in a suitable solvent.

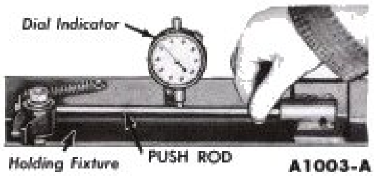


FIG. 25—Push Rod Runout

Blow out the oil passage in the push rods with compressed air.

INSPECTION

Check the ends of the push rods for nicks, grooves, roughness or excessive wear.

The push rods can be visually checked for straightness while they are installed in the engine by rotating them with the valve closed. They also can be checked with a dial indicator (Fig. 25).

CYLINDER HEADS

CLEANING

With the valves installed to protect the valve seats, remove deposits from the combustion chambers and valve heads with a scraper and a wire brush. **Be careful not to damage the cylinder head gasket surface.** After the valves are removed, clean the valve guide bores with a valve guide cleaning tool. Use cleaning solvent to remove dirt, grease, and other deposits.

Remove all deposits from the valves with a fine wire brush or buffing wheel.

INSPECTION

Check the cylinder head for cracks, and the gasket surface for burrs and nicks. Replace the head if it is cracked.

Cylinder Head Flatness. Check the flatness of the cylinder head gasket surface (Fig. 26).

Valve Seat Runout. Check the valve seat runout with an accurate gauge (Fig. 27). Follow the instructions of the gauge manufacturer. If the runout exceeds the wear limit, reface the valve and valve seat.

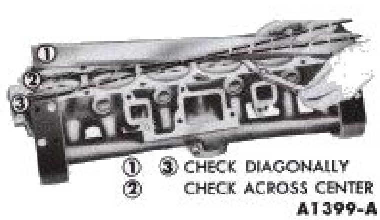


FIG. 26—Typical Cylinder Head Flatness

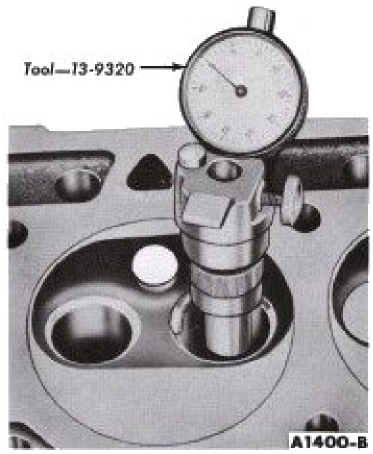


FIG. 27—Typical Valve Seat Runout

Valve Seat Width. Measure the valve seat width (Fig. 20).

The critical inspection points and tolerances of the valves are illustrated in Fig. 28. Inspect the valve face and the edge of the valve head for pits, grooves, scores or other defects. Inspect the stem for a bent condition and the end of the stem for grooves or scores. Check the valve head for signs of burning or erosion, warpage, and cracking. Defects, such as minor pits, grooves, etc., may be removed. Discard valves that are severely damaged.

Inspect the valve springs, valve spring retainers, locks and sleeves for defects.

Valve Face Runout. Check the valve face runout (Fig. 29). It should not exceed the specified wear limit. If the runout exceeds the wear limit, the valve should be refaced or replaced as outlined under "Refacing Valves" in Section 2.

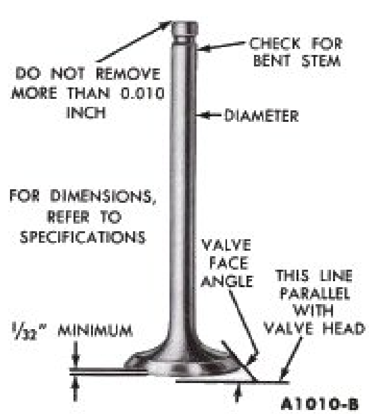


FIG. 28—Critical Valve Tolerances

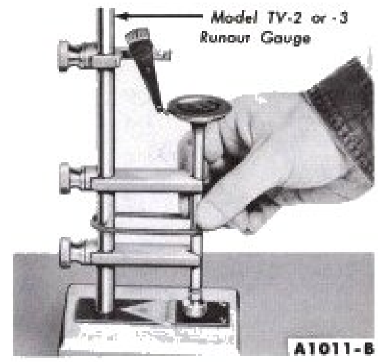


FIG. 29—Valve Face Runout

Valve Stem Clearance. Check the valve stem to valve guide clearance of each valve in its respective valve guide with the tool shown in Fig. 30 or its equivalent.

Valve Spring Pressure. Check the spring for proper pressure (Figs. 31 or 32) at the specified spring lengths. Weak valve springs cause poor engine performance; therefore, if the pressure of any spring approaches the wear limit, replace the spring.

Valve Spring Squareness. Check each spring for squareness using a steel square and a surface plate (Fig. 33). Stand the spring and square on end on the surface plate. Slide the spring up to the square. Revolve the spring slowly and observe the space between the top coil of the spring and the square. If the spring is out of square more than 1/16 inch, replace it.

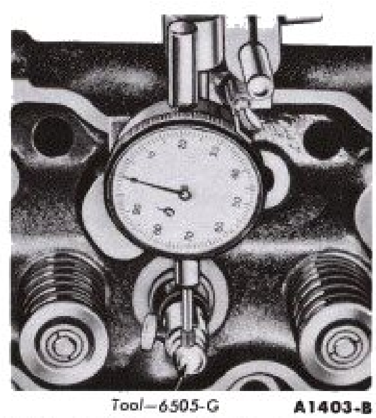


FIG. 30—Typical Valve Stem Clearance

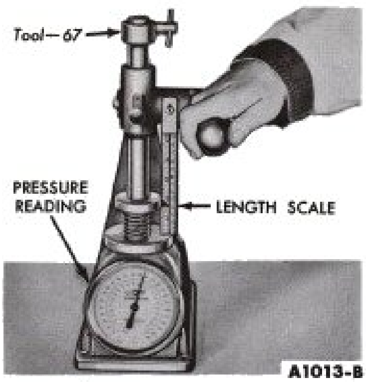


FIG. 31—Valve Spring Pressure —Falcon

HYDRAULIC VALVE LIFTER

The lifter assemblies should be kept in proper sequence so that they can be installed in their original position. Inspect and test each lifter separately so as not to intermix the internal parts. **If any part of the lifter assembly needs replacing, replace the entire assembly.**

FIG. 32—Valve Spring Pressure —Comet

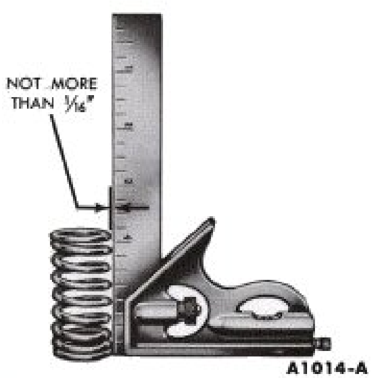


FIG. 33—Valve Spring Squareness

CLEANING

Thoroughly clean all the parts in clean solvent and wipe them with a clean, lint-free cloth.

INSPECTION

Inspect the parts and discard the entire lifter assembly if any part shows signs of pitting, scoring, galling, or evidence of non-rotation. Replace the entire assembly if the plunger is not free in the body. The plunger should drop to the bottom of the body by its own weight.

Assemble the lifter assembly and check for freeness of operation by pressing down on the push rod cup. The lifters can also be checked with a hydraulic tester to test the leak down rate. Follow the instructions of the test unit manufacturer.

TIMING CHAIN AND SPROCKETS

CLEANING

Clean all parts in solvent and dry them with compressed air.

INSPECTION

Inspect the chain for broken links and the sprockets for cracks, and worn or damaged teeth. Replace all components of the timing chain and sprocket assembly if any one item needs replacement.

On the 260 and 289 V-8, inspect the fuel pump drive eccentric for scores, nicks and excessive wear. If the eccentric is scored, replace it.

CAMSHAFT

CLEANING AND INSPECTION

Clean the camshaft in solvent and wipe dry. Inspect the camshaft lobes for scoring, and signs of abnormal wear. Lobe wear characteristics may result in pitting in the general area of the lobe toe. This pitting is not detrimental to the operation of the camshaft; therefore, the camshaft should not be replaced until the lobe lift loss has exceeded 0.005 inch.

The lift of the camshaft lobes can be checked with the camshaft installed in the engine or on centers. Refer to "Camshaft Lobe Lift."

Check the distributor drive gear for broken or chipped teeth.

CRANKSHAFT

CLEANING

Handle the crankshaft with care to avoid possible fractures or dam-

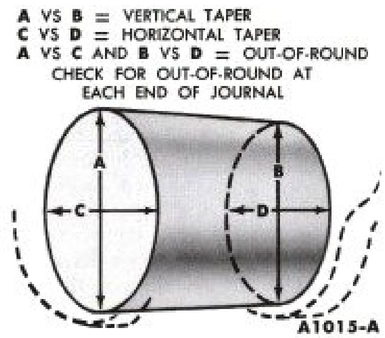


FIG. 34—Crankshaft Journal Measurements

age to the finished surfaces. Clean the crankshaft with solvent, then blow out all oil passages with compressed air.

INSPECTION

Inspect main and connecting rod journals for cracks, scratches, grooves or scores.

Measure the diameter of each journal in at least four places to determine out-of-round, taper or undersize condition (Fig. 34).

On engines used with a manual shift transmission, check the fit of the clutch pilot bushing in the bore of the crankshaft. The bushing is pressed into the crankshaft and should not be loose. Inspect the inner surface of the bushing for wear or a bell-mouth condition. Check the ID of the bushing (Fig. 35). Replace the bushing if it is worn or damaged or the ID is not within specifications.

Inspect the pilot bearing, when used, for roughness, evidence of overheating or loss of lubricant. Replace it if any of these conditions are found.

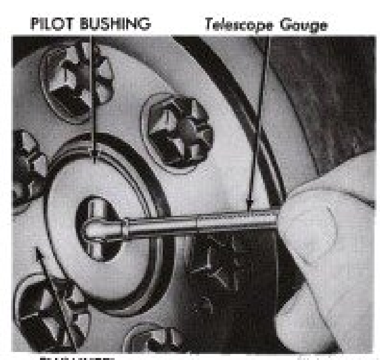


FIG. 35—Typical Clutch Pilot Bushing Wear Check

FLYWHEEL—MANUAL-SHIFT TRANSMISSIONS

INSPECTION

Inspect the flywheel for cracks, heat check, or other defects that would make it unfit for further service. Machine the friction surface of the flywheel if it is scored or worn. If it is necessary to remove more than 0.045 inch of stock from the original thickness, replace the flywheel.

Inspect the ring gear for worn, chipped, or cracked teeth. If the teeth are damaged, replace the ring gear.

With the flywheel installed on the crankshaft, check the flywheel face runout, following the procedure in Section 1.

CONNECTING RODS

CLEANING

Remove the bearings from the rod and cap. Identify the bearings if they are to be used again. Clean the connecting rod in solvent, including the rod bore and the back of the inserts. **Do not use a caustic cleaning solution.** Blow out all passages with compressed air.

INSPECTION

The connecting rods and related parts should be carefully inspected and checked for conformance to specifications. Various forms of engine wear caused by these parts can be readily identified.

A shiny surface on the pin boss side of the piston usually indicates that a connecting rod is bent or the piston pin hole is not in proper relation to the piston skirt and ring grooves.

Abnormal connecting rod bearing wear can be caused by either a bent connecting rod, an improperly machined crankpin, or a tapered connecting rod bore.

Twisted connecting rods will not create an easily identifiable wear pattern, but badly twisted rods will disturb the action of the entire piston, rings, and connecting rod assembly and may be the cause of excessive oil consumption.

Inspect the connecting rods for signs of fractures and the bearing bores for out-of-round and taper. If the bore exceeds the recommended limits and/or if the connecting rod is fractured, it should be replaced.

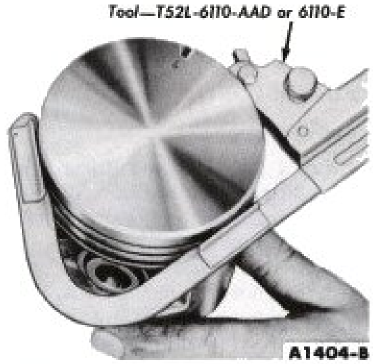


FIG. 36—Cleaning Ring Grooves

Check the I.D. of the connecting rod piston pin bore. Replace the connecting rod if the pin bore is not within specifications.

Replace defective connecting rod nuts and bolts.

After the connecting rods are assembled to the piston, check the connecting rods for bend or twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. If the bend and/or twist is excessive, the connecting rod should be straightened or replaced.

PISTONS, PINS AND RINGS

CLEANING

Remove deposits from the piston surfaces. Clean gum or varnish from the piston skirt, piston pins, and rings with solvent. **Do not use a caustic cleaning solution or a wire brush to clean pistons.** Clean the ring grooves with a ring groove cleaner (Fig. 36). Make sure the oil ring slots (or holes) are clean.

INSPECTION

Carefully inspect the pistons for fractures at the ring lands, skirts, and pin bosses, and for scuffed, rough, or scored skirts. If the lower inner portion of the ring grooves has a high step, replace the piston. The step will interfere with ring operation and cause excessive ring side clearance.

Spongy, eroded areas near the edge of the top of the piston are usually caused by detonation, or pre-ignition. A shiny surface on the thrust surface of the piston, offset from the centerline between the piston pin holes, can be caused by a bent connecting rod. Replace pistons that show signs of excessive wear, wavy ring lands, fractures, and/or damage from detonation or pre-ignition.

Check the piston to cylinder bore clearance with a tension scale and ribbon, following the procedure under "Fitting Pistons" in Section 2. Check the ring side clearance following the procedure under "Fitting Piston Rings" in Section 2.

Replace piston pins showing signs of fracture or etching and/or wear. Check the piston pin fit in the piston and rod. Refer to "Pistons and Connecting Rods Assembly" in the pertinent engine section.

Check the O.D. of the piston pin and the I.D. of the pin bore in the piston. Replace any piston pin or piston that is not within specifications.

Replace all rings that are scored, chipped, or cracked. Check the end gap and side clearance. It is good practice to always install new rings when overhauling the engine. Rings should not be transferred from one

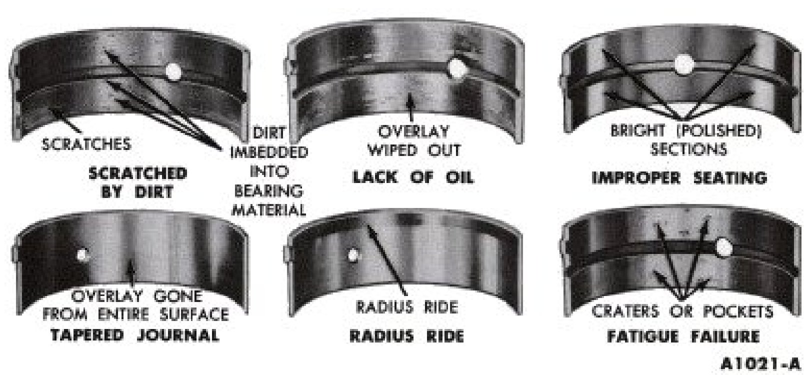


FIG. 37—Typical Bearing Failures

piston to another regardless of mileage.

MAIN AND CONNECTING ROD BEARINGS

CLEANING

Clean the bearing inserts and caps thoroughly in solvent, and dry with compressed air. **Do not scrape gum or varnish deposits from the bearing shells.**

INSPECTION

Inspect each bearing carefully. Bearings that have a scored, chipped, or worn surface should be replaced. Typical examples of bearing failures and their causes are shown in Fig. 37. The copper lead bearing base may be visible through the bearing overlay. This does not mean that the bearing is worn. Do not replace the bearing if the bearing clearance is within recommended limits. Check the clearance of bearings that appear to be satisfactory with Plastigage. Fit new bearings following the recommended procedure in the pertinent part of Group 8.

CYLINDER BLOCK

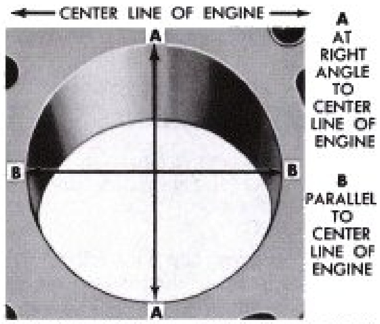
CLEANING

Thoroughly clean the block in solvent. Remove old gasket material from all machined surfaces. Remove all pipe plugs which seal oil passages, then clean out all the passages. Blow out all passages, bolt holes, etc. with compressed air. Make sure the threads in the cylinder head bolt holes are clean. Dirt in the threads may cause binding and result in a false torque reading. Use a tap to true-up threads and to remove any deposits.

INSPECTION

After the block has been thoroughly cleaned, make a check for cracks. Minute cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25% kerosene and 75% light motor oil. Wipe the part dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If cracks are present, the coating will become discolored at the defective area. Replace the block if it is cracked.

Check all machined gasket surfaces for burrs, nicks, scratches, and scores. Remove minor imperfections with an oil stone. Check the flatness



1. OUT-OF-ROUND = DIFFERENCE BETWEEN A AND B
2. TAPER = DIFFERENCE BETWEEN THE A MEASUREMENT AT TOP OF CYLINDER BORE AND THE A MEASUREMENT AT BOTTOM OF CYLINDER BORE A1025-A

FIG. 38—Cylinder Bore Out-of-Round and Taper

of the cylinder block gasket surface following the procedure and specifications recommended for the cylinder head.

Replace all expansion-type plugs that show evidence of leakage.

Inspect the cylinder walls for scoring, roughness, or other signs of wear. Check the cylinder bore for out-of-round and taper. Measure the bore with an accurate gauge following the instructions of the manufacturer. Measure the diameter of each cylinder bore at the top, middle, and bottom with the gauge placed at right angles and parallel to the centerline of the engine (Fig. 38).

Refinish cylinders that are deeply scored and/or when out-of-round and/or taper exceed the wear limits.

If the cylinder walls have minor surface imperfections, but the out-of-round and taper are within limits, it may be possible to remove the imperfections by honing the cylinder walls and installing new service piston rings providing the piston clearance is within limits. Use the finest grade of honing stone for this operation.

OIL PAN

CLEANING

Scrape any dirt or metal particles from the inside of the pan. Scrape all old gasket material from the gasket surface. Wash the pan in a solvent and dry it thoroughly. Be sure all foreign particles are removed from below the baffle plate.

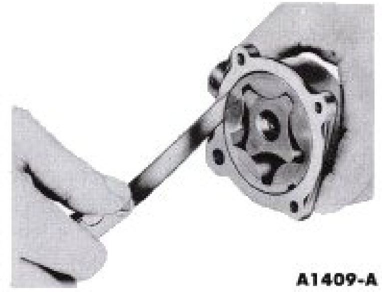


FIG. 39—Outer Race to Housing Clearance

INSPECTION

Check the pan for cracks, holes, damaged drain plug threads, a loose baffle, and a nicked or warped gasket surface.

Repair any damage, or replace the pan if repairs can not be made.

OIL PUMP

CLEANING

Wash all parts in a solvent and dry them thoroughly with compressed air. Use a brush to clean the inside of the pump housing and the pressure relief valve chamber. Be sure all dirt and metal particles are removed.

INSPECTION

Check the inside of the pump housing and the outer race and rotor for damage or excessive wear.

Check the mating surface of the pump cover for wear. If the cover mating surface is worn, scored, or grooved, replace the cover.

Measure the outer race to housing clearance (Fig. 39) which should be to specifications.

With the rotor assembly installed in the housing, place a straight edge over the rotor assembly and the housing. Measure the clearance between the straight edge and the rotor and outer race (Fig. 40) which should be to specifications.

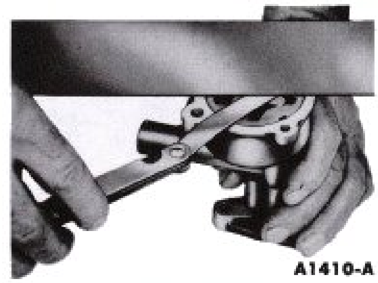


FIG. 40—Rotor End Play

The outer race, shaft and rotor are replaceable only as an assembly.

Check the drive shaft to housing bearing clearance by measuring the OD of the shaft and the ID of the housing bearing.

Inspect the relief valve spring for a collapsed or worn condition.

Check the relief valve spring tension. If the spring tension is not within specifications and/or the spring is defective, replace the spring.

Check the relief valve piston for scores and free operation in the bore.

CRANKCASE VENTILATION SYSTEM MAINTENANCE

Refer to Group 19 for the correct mileage interval for maintenance.

CLEANING

The breather cap located on the rocker arm cover should be cleaned with a solvent at the proper mileage interval. **Do not oil the mesh screen after cleaning.**

At the recommended interval, remove the crankcase ventilation regulator valve, vent hose and hose connections. Clean the valve in clean carburetor solvent and dry it with compressed air. Clean the rubber hose with a low-volatile petroleum base solvent and dry it with compressed air. Clean the orifice in the carburetor spacer or intake manifold fitting.

PART 8-2 144, 170 AND 200 SIX

1 DESCRIPTION AND OPERATION

The 144, 170 and 200 Six engines (Figs. 1, 2 and 3) have the same basic design with a compression ratio of 8.7:1. The 144 Six engine has a piston displacement of 144 cubic inches and the patent plate identification symbol is "S". The 170 Six engine has a piston displacement of 170 cubic inches and the patent plate identification symbol is "U". The 200 Six engine has a piston displacement of 200 cubic inches and the patent plate symbol is "T".

MANIFOLDS

Exhaust gases provide the heat necessary to assist in vaporizing the incoming fuel mixture.

To prevent carburetor icing at the throttle plate, a spacer, heated by engine coolant, is located between the carburetor and the intake manifold (Fig. 4) The coolant flows from the front of the engine through the spacer inlet hose into the carburetor coolant spacer. The coolant circulates through the spacer and flows into the heater inlet hose and into the heater. On cars that do not have a heater the coolant flows through the spacer and flows into the return hose and into the water pump.

CYLINDER HEAD

The cylinder head carries the valves, valve rocker arm shaft assembly, intake manifold assembly, the coolant outlet and thermostat. Valve guides are integral with the head.

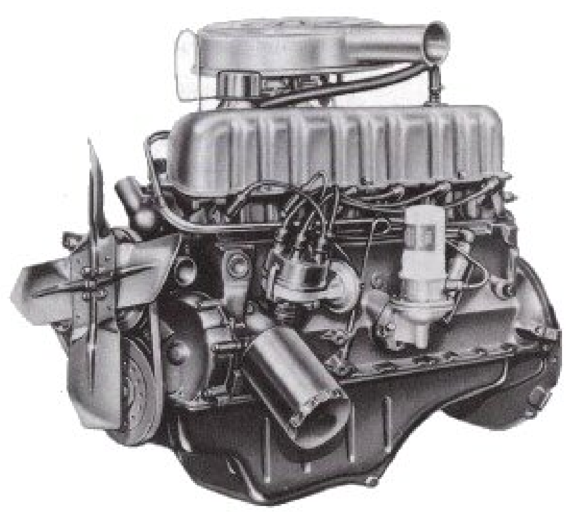


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FIG. 1—Typical ¾ Left Front View

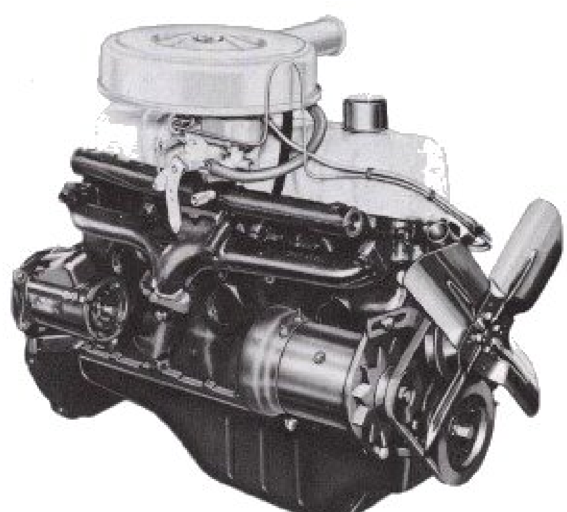

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FIG. 2—Typical ¾ Right Front View

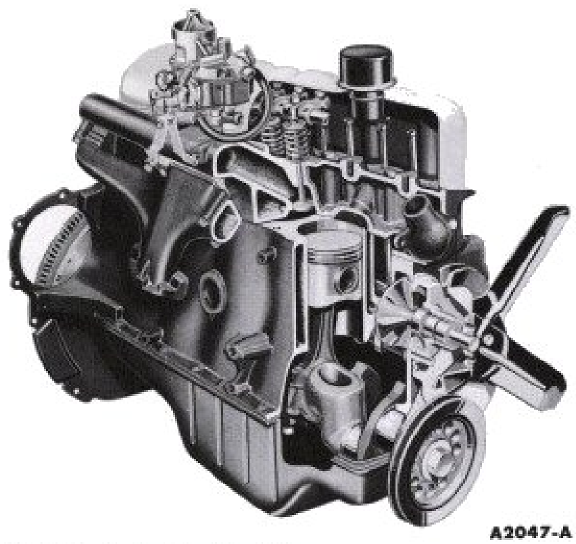

FIG. 3—Typical Sectional View

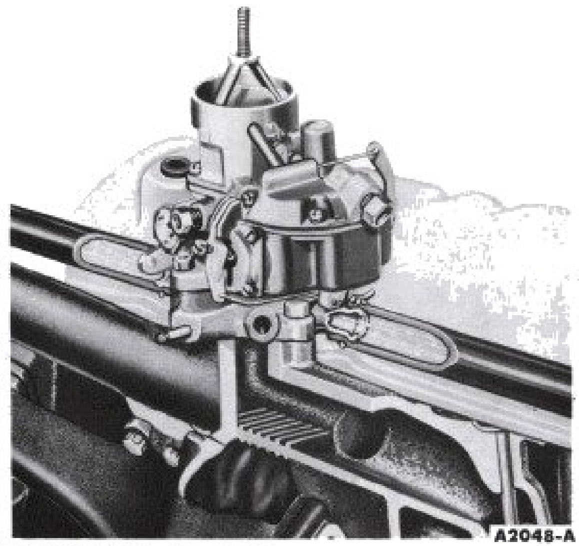

FIG. 4—Water Heated Spacer

The valves are arranged from front to rear E-I-I-E-I-E-E-I-E-I-I-E.

CYLINDER BLOCK

The cylinders are numbered from 1 to 6 starting at the front of the engine. The firing order is 1-5-3-6-2-4.

The distributor, located on the left front of the engine, drives the oil pump through an intermediate drive shaft.

The crankshaft is supported by four main bearings. Crankshaft end thrust is controlled by the flanges of the No. 3 main bearing.

The pistons have two compression rings and one oil control ring. The top compression ring is chrome-plated and the lower compression ring is phosphate-coated. The oil control ring assembly consists of a serrated spring and two chrome-plated steel rails.

VALVE TRAIN

The 144, 170 and 200 Six engines utilize hydraulic valve lifters to provide zero lash. The operation and parts identification of the hydraulic valve lifters are shown in Fig. 5.

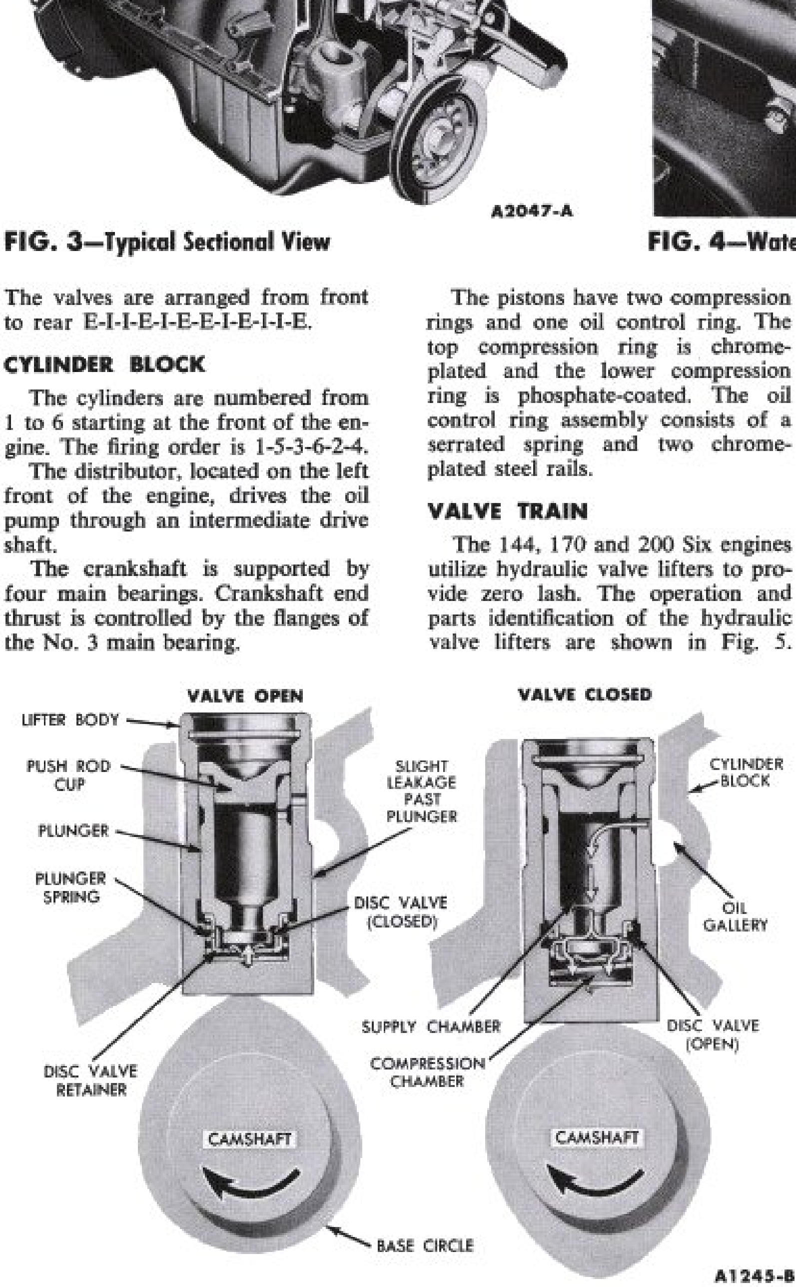

FIG. 5—Hydraulic Valve Lifter Operation

When the valve is closed, the lifter assembly is on the base circle of the camshaft lobe and the valve push rod is in its lowest position. With the lifter assembly in this position, the plunger spring expands, forcing the plunger upward. This action is transmitted to the valve rocker arm via the valve push rod until there is solid contact between the valve and the valve end of valve rocker arm (zero valve lash). In this position, the oil hole in the lifter and plunger is indexed with the lifter oil gallery in the cylinder block.

As the lifter plunger moves upward, the volume of the compression chamber is increased, resulting in reduced oil pressure in the compression chamber. Therefore, to equalize the resulting pressure differential between the supply chamber and the compression chamber, the disc valve moves off its seat and permits oil to flow from the supply chamber to the compression chamber. When the compression chamber becomes filled with oil, the pressures in the two chambers are equalized. The oil flow ceases and the disc valve spring seats the disc valve and closes the disc valve port.

As the camshaft rotates, the lifter assembly is raised by the camshaft lobe. This increases the push rod force against the lifter plunger and hydraulic pressure immedately builds up in the compression chamber until it acts as a solid member of the valve operating mechanism. The lifter then becomes a hydraulic ram which forces the valve in the cylinder head

to open. During this period, a slight leakage of oil past the plunger occurs (calibrated leak down rate).

As the high point of the camshaft lobe rotates and passes by the foot of the valve lifter, the valve in the cylinder head seats and the valve lifter assembly is forced downward. Reduced force on the lifter plunger at this time relieves the pressure on the lifter plunger and it is free to be moved upward by the plunger spring. This action allows oil to flow once again through the indexed oil holes in the lifter body and plunger.

The operating cycle is completed for each revolution of the camshaft. Zero clearance (lash) in the valve train mechanism is maintained at all times by the hydraulic force and expansion of the plunger spring between the lifter body and plunger.

LUBRICATION SYSTEM

Oil from the oil pan sump is forced through the pressure-type lubrication system (Fig. 6) by a rotor pump. A spring-loaded relief valve in the pump limits the maximum pressure of the system. Oil relieved by the valve is directed back to the intake side of the pump.

All the oil discharged by the pump passes through a full flow-type Rotunda filter before it enters the engine. The filter has an integral by-pass valve and mounting gasket. The by-pass valve permits oil to bypass the filter if it becomes clogged, thereby maintaining an emergency supply of oil to the engine at all times. An anti-drain back diaphragm prevents a reverse flow of oil when the engine is stopped.

From the filter, the oil flows into the main oil gallery. The oil gallery supplies oil to all the camshaft and main bearings through a drilled passage in each main bearing web.

Oil from the main oil gallery feeds the valve lifter assemblies. A reservoir at each valve lifter bore boss traps oil so that oil is available for valve lifter lubrication as soon as the engine starts.

The timing chain and sprockets are splash-lubricated from the oil pan.

Oil slingers prevent leakage by directing oil away from the crankshaft front and rear oil seals.

Cylinder walls, pistons and piston pins are lubricated through a drilled hole in each connecting rod which indexes with a drilled hole in the connecting rod journal of the crankshaft.

Oil under reduced pressure is fed to the valve rocker arm shaft assembly through a drilled passage in the cylinder block at the No. 4 camshaft bearing. The oil is metered by a groove in the camshaft journal. The passage in the block indexes with a hole in the cylinder head. The oil passage in the cylinder head is drilled from the cylinder head bolt bore to the No. 6 valve rocker arm shaft support. The rocker arm shaft supports have a square cored bolt mounting hole for more positive lubrication of the rocker arms, shafts and valves. The oil flows through the valve rocker arm shaft through drilled holes in each rocker arm to lubricate the valve and the ball end of the rocker arm. The excess oil spirals down the rotating push rod and assists in lubricating the valve lifter and push rod seat. An oil outlet in the No. 1 rocker arm shaft support, exhausts excess oil from the valve rocker arm shaft. The oil from each rocker arm drains into the push rod chamber through the push rod bore holes in the cylinder head.

The oil in the push rod chamber drains back into the oil pan through cored openings in the block.

POSITIVE CRANKCASE VENTILATION SYSTEM

The air flow in the positive crankcase ventilation system is shown in Fig. 7.

Ventilating air enters the engine through the oil filler cap located on

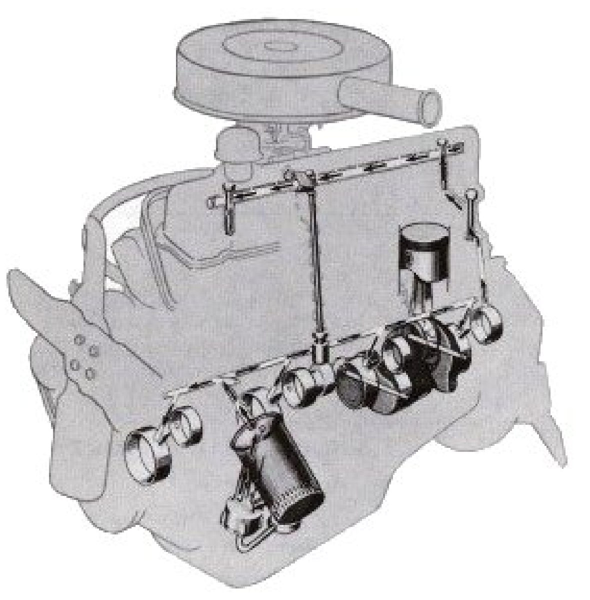
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FIG. 6—Lubrication System

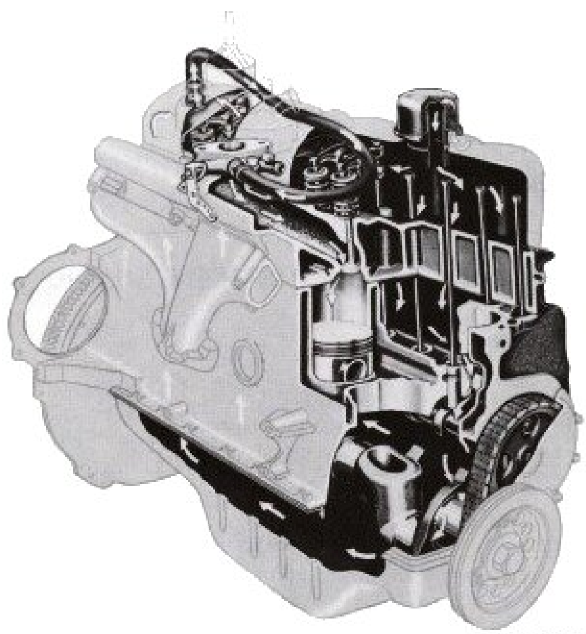
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FIG. 7—Typical Positive Crankcase Ventilation System

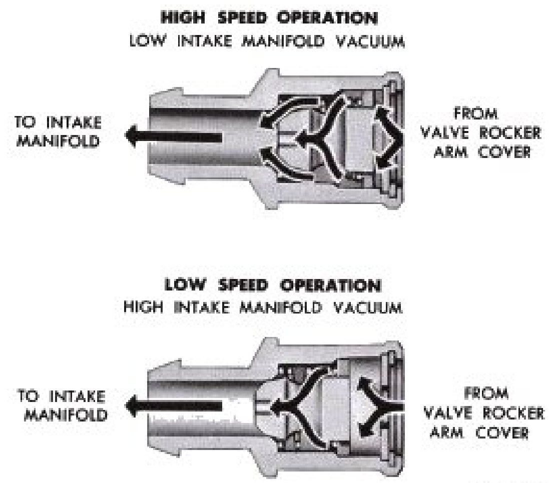

FIG. 8—Positive Crankcase Ventilation Regulator Valve Operation

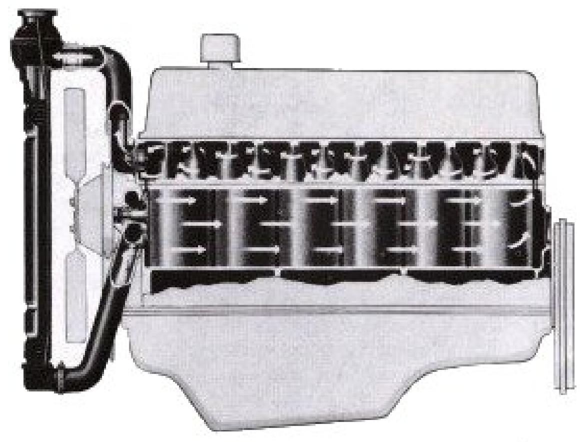

FIG. 9—Cooling System

the front of the valve rocker arm cover. The filler cap contains a filtering element which filters the incoming air.

From the oil filler cap, the air flows into the front section of the valve rocker arm shaft chamber. The ventilating air moves down past the push rods and into the crankcase. Air is diverted from the front section of the crankcase through holes in the front of the cylinder block wall to ventilate the timing chain chamber.

The rotating action of the crankshaft causes the air to flow towards the rear of the crankcase and up into the rear section of the valve rocker arm cover. The air then enters a spring-loaded regulator valve that regulates the amount of air to meet changing operating conditions. The air is then directed to the intake manifold through the crankcase vent hose.

During idle, intake manifold vacuum is high. The high vacuum overcomes the tension of the spring pressure and seats the valve (Fig. 8). With the valve in this position, all the ventilating air passes through a calibrated orifice in the valve. With the valve seated, there is minimum ventilation. As engine speed increases and manifold vacuum decreases, the spring forces the valve off its seat and to the full open position (Fig. 8). This increases the flow of ventilating air.

COOLING SYSTEM

The coolant is drawn from the bottom of the radiator by the water pump which delivers the coolant to the cylinder block (Fig. 9).

As the coolant enters the block, it travels through cored passages to cool the entire length of each cylinder wall. Upon reaching the rear of the cylinder block, the coolant is directed upward into the cylinder head where it cools the combustion chambers, valves, and valve seats on its return to the front of the engine.

At this point, the coolant flows into the coolant outlet connection, past the thermostat if it is open, and into the top of the radiator. If the thermostat is closed, a small portion of the coolant is returned to the water pump for recirculation. The entire system is pressurized to 13-15 psi.

2 IN-CAR ADJUSTMENTS AND REPAIRS

ENGINE SUPPORTS

The engine front supports are located on each side of the crankcase (Fig. 10), and the cantilever leaf-spring rear support is located at the transmission extension housing (Fig. 11).

ENGINE FRONT SUPPORTS

The procedures given apply to either a right or left installation.

Removal

1. Remove the insulator to support bracket nuts and washers from both insulators (Fig. 10).

2. Raise the engine with a jack and wood block placed under the oil pan.

3. Remove the insulator to engine bolts and washers and remove the insulator.

Installation

1. Position the insulator assembly (Fig. 10) on the engine and install the insulator to engine bolts and washers finger-tight.

2. Lower the engine carefully to make sure the insulator stud engages the hole in the support bracket.

3. Install the insulator to support bracket washer and nut on both engines front mounts. Tighten the insulator bolts and nuts to specifications.

ENGINE REAR SUPPORT

Removal

1. Disconnect the parking brake equalizer lever from the support bracket.

2. Support the transmission with a floor jack. Remove the leaf-spring center bolt and lower insulator (Fig. 11). Remove the leaf-spring to transmission extension housing attaching

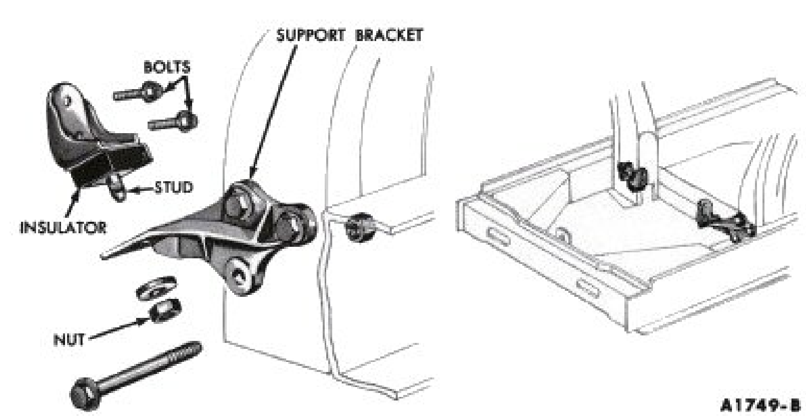

FIG. 10—Engine Front Supports

bolts. Remove the leaf-spring and flat rubber washer.

3. Remove the support bracket to body cross member bolts, and remove the support bracket and upper insulator assembly and spring clip nut retainer.

4. Remove two bolts to disassemble the support bracket and upper insulator.

Installation

1. Assemble the support bracket and upper insulator (Fig. 11) and tighten the bolts and nuts to specifications.

2. Position the spring clip nut retainer on the upper insulator and support bracket assembly, and install the support bracket assembly on the body cross member. **Make sure there is a minimum clearance of 0.20 inch between the transmission extension housing and the upper insulator.** Tighten the support bracket to body cross member bolts to specifications.

3. Position the flat rubber washer on top of the leaf-spring and install the leaf-spring on the transmission extension housing. Torque the bolts to specifications.

4. Install the lower insulator and center bolt, and tighten the center bolt to specifications. Remove the transmission jack.

5. Connect the parking brake equalizer lever to the support bracket.

EXHAUST MANIFOLD

REMOVAL

1. Remove the air cleaner. Disconnect the muffler inlet pipe from the exhaust manifold.

2. Bend the exhaust manifold retaining bolt lock tabs back and remove the retaining bolts. Remove the exhaust manifold.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Clean the mating surfaces of the exhaust manifold and cylinder head. Scrape the gasket material from the mounting flange of the exhaust manifold and muffler inlet pipe.

2. Apply graphite grease to the mating surface of the exhaust manifold.

3. Position the exhaust manifold on the cylinder head and install the retaining bolts and tab washers. Working from the center to the ends, torque the bolts to specifications. Lock the bolts by bending one tab of the washer over a flat on the bolt.

4. Place a new gasket on the muffler inlet pipe. Position the muffler inlet pipe to the manifold. Install and torque the retaining nuts to specifications.

5. Install the air cleaner. Start the engine and check for exhaust leaks.

POSITIVE CRANKCASE VENTILATION SYSTEM

The positive crankcase ventilation system components are shown in Fig. 12.

REMOVAL

1. Remove the air cleaner.

2. Grasp the crankcase vent hose near the rocker arm cover grommet and pull to remove the regulator valve from the rocker arm cover.

3. Using hose clamp pliers, slide both hose clamps towards the center of the vent hose. Remove the regulator valve from the vent hose and remove the vent hose from the hose fitting in the intake manifold.

4. Remove the vent hose fitting from the intake manifold.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Install the vent hose fitting in the intake manifold.

2. Position the hose clamps on the

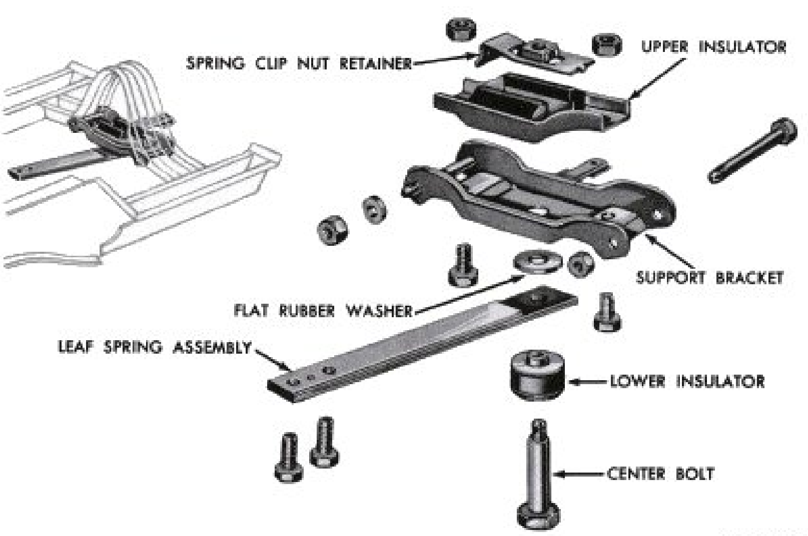

FIG. 11—Engine Cantilever Leaf—Spring Rear Support

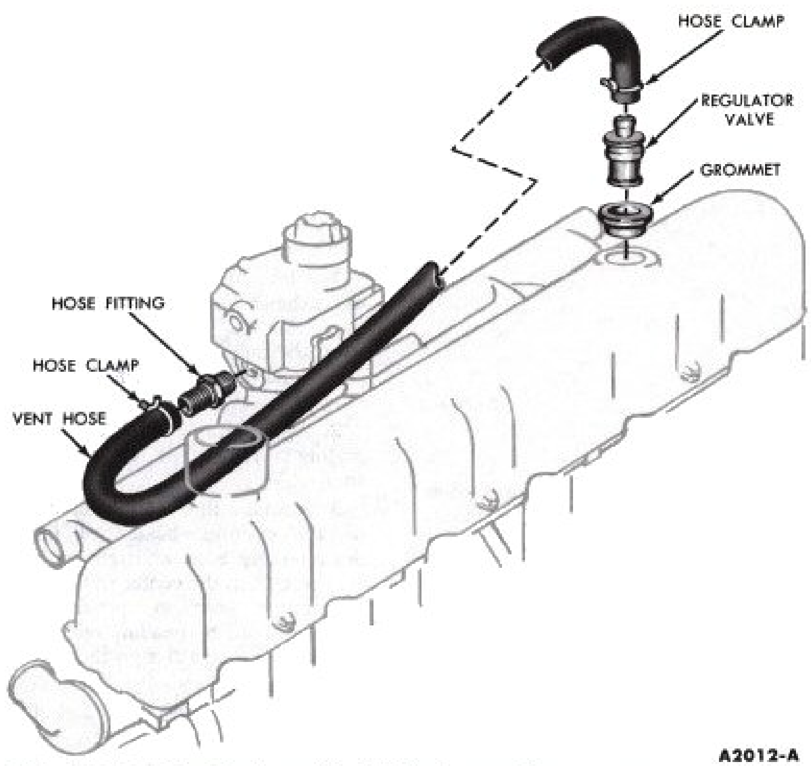

FIG. 12—Positive Crankcase Ventilation System Components

vent hose. Install the hose on the fitting in the intake manifold and the regulator valve in the hose. Using hose clamp pliers, slide the clamps into position.

3. Insert the regulator valve into the rocker arm cover mounting grommet.

4. Install the air cleaner. Operate the engine and check for leaks.

REGULATOR VALVE DISASSEMBLY

When disassembling or assembling the regulator valve, exercise care to avoid damaging the calibrated spring. Under no circumstances should the spring be altered in any manner.

Using a snap ring retainer tool, remove the snap ring retainer from the end of the regulator valve assembly. Remove the valve retaining washer. **Soak the valve body, spring and valve in solvent as necessary, until the valve spring can be easily removed without distorting it.**

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

TESTING

Refer to Part 8-1, Section 1 for the test procedures.

REGULATOR VALVE ASSEMBLY

Install the spring and valve into the valve body. **Be sure the pointed end of the valve is toward the hose connection (Fig. 13).** Install the valve retaining washer and snap ring retainer.

VALVE ROCKER ARM SHAFT ASSEMBLY

REMOVAL

1. Remove the air cleaner. Grasp the crankcase vent hose near the regulator valve and pull the regulator valve out of the valve rocker arm cover. Position the vent hose and the regulator valve out of the way.

2. Remove the valve rocker arm cover and discard the gasket.

3. Remove the rocker arm shaft support bolts by loosening the bolts two turns at a time in sequence. Remove the rocker arm shaft assembly (Fig. 14). Remove the valve push rods.

INSTALLATION

1. Position the No. 1 piston approximately at TDC (timing mark) on the compression stroke; then turn the crankshaft 60° in the direction of engine rotation (clockwise as viewed from front of engine). **This procedure should be followed to avoid damage to the valve mechanism.**

2. Apply Lubriplate to both ends of the push rods and to the valve stem tip.

3. Install the valve push rods. Position the valve rocker arm shaft assembly on the cylinder head.

4. Install and tighten all valve rocker arm support bolts, two turns at a time in sequence, until the supports fully contact the cylinder head. Torque the bolts to specifications.

5. Adjust the valve lash, following the procedure outlined under "Valve Clearance—144, 170 and 200 Six" (Part 8-1, Section 2).

6. Clean the valve rocker arm cover and cylinder head gasket surfaces. Coat one side of a new gasket with an oil resistant sealer and lay the cemented side of the gasket in place on the cover (Fig. 15). Install

FIG. 13—Regulator Valve Assembly

FIG. 14—Valve Rocker Arm Shaft Removal

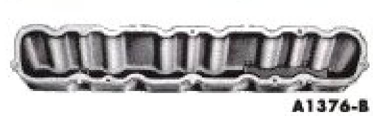

FIG. 15—Valve Rocker Arm Cover Gasket Installation

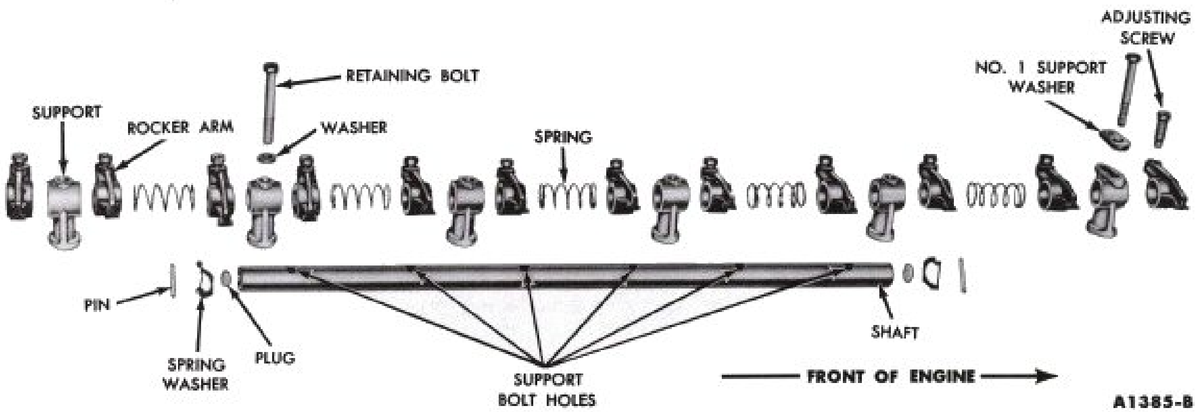

FIG. 16—Valve Rocker Arm Shaft Assembly

the cover, making sure the gasket seats evenly around the head. Tighten the cover retaining bolts in two steps. First, torque the bolts to specifications; then, retorque to the same specifications two minutes after initial tightening.

7. Insert the regulator valve (with the vent hose attached) into the valve rocker arm cover mounting grommet. Install the air cleaner.

DISASSEMBLY

1. Remove the pin and spring washer from each end of the valve rocker arm shaft.

2. Slide the valve rocker arms, springs, and supports off the shaft. Be sure to identify the parts.

3. If it is necessary to remove the plugs from each end of the shaft, drill or pierce the plug on one end. Use a steel rod to knock out the plug on the opposite end. Working from the open end, knock out the remaining plug.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Refer to Part 8-1, Section 2 for the repair procedures.

ASSEMBLY

1. Lubricate all parts with engine oil. Apply Lubriplate to the valve and push rod ends of the rocker arm.

2. If the plugs were removed from the ends of the shaft, use a blunt tool or large diameter pin punch and install a plug, cup side out, in each end of the shaft.

3. Install the spring washer and pin on one end of the shaft.

4. Install the valve rocker arms, supports, and springs in the order shown in Fig. 16. **Be sure the oil holes in the shaft are facing downward. Complete the assembly by installing the remaining spring washer and pin.**

CYLINDER HEAD

REMOVAL

1. Drain the cooling system. Remove the air cleaner.

2. Disconnect the muffler inlet pipe at the exhaust manifold. Pull the muffler inlet pipe down. Remove the gasket.

3. Disconnect the accelerator rod retracting spring. Disconnect the choke control cable and the accelerator rod at the carburetor.

4. Disconnect the fuel inlet line and the distributor vacuum line at the carburetor.

5. Disconnect the coolant lines at the carburetor spacer.

6. Disconnect the distributor vacuum line at the distributor. Disconnect the carburetor fuel inlet line at the fuel pump. Remove the lines as an assembly.

7. Disconnect the spark plug wires at the spark plugs and the temperature sending unit wire at the sending unit.

8. Grasp the crankcase vent hose near the regulator valve and pull the regulator valve out of the grommet in the valve rocker arm cover. Disconnect the crankcase vent hose at the hose fitting in the intake manifold spacer and remove the vent hose and regulator valve.

9. Remove the valve rocker arm cover.

10. Remove the valve rocker arm shaft assembly. Remove the valve push rods in sequence (Fig. 17).

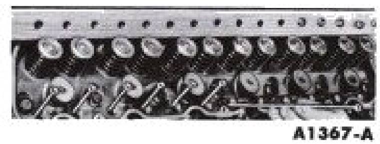

FIG. 17—Valve Push Rod Removal

11. Remove one cylinder head bolt from each end of the head and install the cylinder head guide studs (Fig. 18). Remove the remaining cylinder head bolts and remove the cylinder head. **Do not pry between the cylinder head and block as the gasket surfaces may become damaged.**

INSTALLATION

1. Clean the head and block gasket surfaces. If the cylinder head was removed for a gasket change, check the flatness of the cylinder head and block.

2. Apply cylinder head gasket sealer to both sides of a new gasket. Use the brush furnished to spread the sealer evenly over the entire gasket surface. Position the gasket over the guide studs on the cylinder block.

FIG. 18—Cylinder Head Guide Studs

3. Install a new gasket on the flange of the muffler inlet pipe.

4. Lift the cylinder head over the guides and slide it down carefully, guiding the exhaust manifold studs into the muffler inlet pipe.

5. Coat the threads of the Nos. 1 and 6 bolts for the right side of the cylinder head with a small amount of water resistant sealer. Install, but do not tighten two bolts at opposite ends of the head to hold the head and gasket in position. Remove the guides and install the remaining bolts.

6. The cylinder head bolts are tightened in three progressive steps. Torque all the bolts in sequence (Fig. 19) to 55 ft-lbs, then to 65 ft-lbs, and finally to specifications. **After the cylinder head bolts have been torqued to specifications, the bolts should not be disturbed.**

FIG. 19—Cylinder Head Bolt Torque Sequence

7. Apply Lubriplate to both ends of the push rods. Install the push rods in their original bores, positioning the lower end of the rods into the tappet sockets. Apply Lubriplate to the valve stem tips and to the rocker arm pads.

8. Install the valve rocker arm shaft assembly following steps 1 thru 7 under "Valve Rocker Arm Shaft Installation."

Adjust the valve lash, following the procedure outlined under "Valve Clearance" (Part 8-1, Section 2).

9. Install a new gasket on the muffler inlet pipe. Install the muffler inlet pipe lock washers and retaining nuts. Torque the nuts to specifications.

10. Connect the radiator upper hose at the coolant outlet housing. Connect the coolant hoses at the carburetor spacer.

11. Position the distributor vacuum line and the carburetor fuel inlet line on the engine. Connect the fuel line and the distributor vacuum line at the carburetor.

12. Connect the accelerator rod retracting spring. Connect the choke control cable and the accelerator rod at the carburetor. Adjust the choke control cable.

13. Connect the distributor vacuum line at the distributor. Connect the carburetor fuel inlet line at the fuel filter.

14. Connect the temperature sending unit wire at then sending unit. Connect the spark plug wires. **Be sure the wires are forced all the way down into their sockets.**

15. Fill and bleed the cooling system.

16. Connect the crankcase vent hose at the intake manifold spacer fitting. Insert the regulator valve (with the vent hose attached) into the valve rocker arm cover mounting bracket.

17. Start the engine and check for coolant and oil leaks.

DISASSEMBLY

1. Install the cylinder head holding fixtures (Fig. 20). Remove deposits from the combustion chambers and valve heads with a scraper and a wire brush before removing the valves. **Be careful not to scratch the cylinder head gasket surfaces.**

2. Compress the valve springs (Fig. 21). Remove the valve retainer locks and release the spring. If the valve locks are stuck, place a piece of steel tubing (¾-inch OD, ½-inch ID and 3-inches long) over the end of the valve stem squarely against the sleeve surface. Tap the tube with a steel hammer to dislodge the locks.

3. Remove the sleeve, spring retainer, stem seal, and valve. Discard the valve. Discard the valve stem seals. Identify all valve parts.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

FIG. 20—Cylinder Head Holding Fixtures

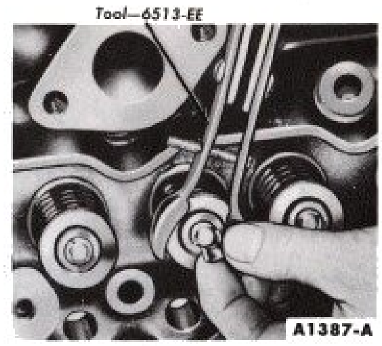

FIG. 21—Compressing Valve Spring—On Bench

REPAIRS

Refer to Part 8-1, Section 2 for repair procedures.

ASSEMBLY

1. Lubricate the valve guides and valve stems with engine oil. Apply Lubriplate to the tip of the valve stems.

2. Install each valve (Fig. 22) in the valve guide from which it was removed or to which it was fitted. Install a new stem seal on the valve.

3. Install the valve spring assembly over the valve. Install the spring retainer and sleeve.

4. Compress the spring and install the retainer locks (Fig. 21).

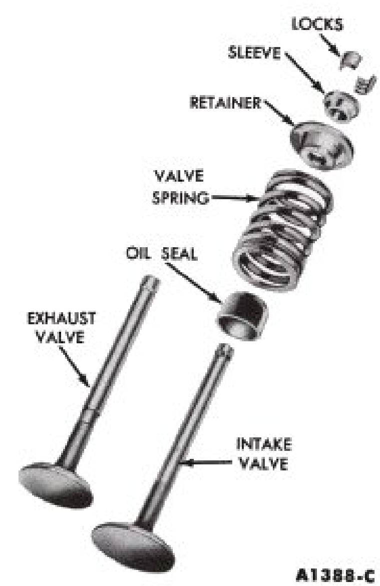

FIG. 22—Valve Assembly

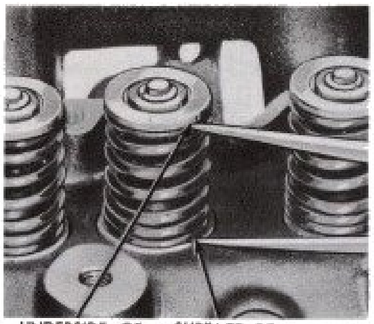

FIG. 23—Valve Spring Assembled Height

5. Measure the assembled height of the valve spring from the surface of the cylinder head spring pad to the underside of the spring retainer with dividers (Fig. 23).

6. Check the dividers against a scale. If the assembled height is greater than specifications, install the necessary 0.030-inch thick spacer(s) between the cylinder head spring pad and the valve spring to bring the assembled height to the recomended dimension. **Do not install spacers unless necessary. Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which would lead to spring breakage and worn camshaft lobes.**

VALVE SPRING, RETAINER AND STEM SEAL REPLACEMENT

Broken valve springs or defective valve stem seals and retainer may be replaced without removing the cylinder head, provided damage to the valve or valve seat has not occurred.

1. Remove the air cleaner. Remove the crankcase ventilation regulator valve from the valve rocker arm cover and remove the valve rocker arm cover. Remove the applicable spark plug.

2. Crank the engine until the applicable cylinder is on TDC after the compression stroke. Be sure that both valves are closed. **Make sure that the piston is on TDC to prevent the crankshaft from turning when the air is supplied.**

3. Loosen the valve rocker arm adjusting screw to remove the valve spring load. Remove the valve push rod.

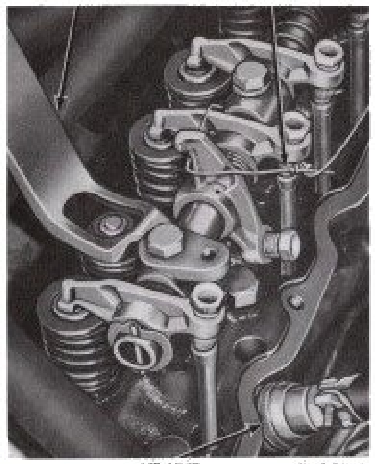

FIG. 24—Compressing Valve Spring—In Chassis

4. Install an air line with an adapter in the spark plug hole.

5. Push the rocker arm to one side and secure it in this position (Fig. 24). To move the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and spring washer and slide the rocker arm off the shaft.

6. Turn on the air supply. Using the valve spring compression tool shown in Fig. 24, compress the valve and remove the valve spring retainer locks, the sleeve, spring retainer and the valve spring.

7. Remove the valve stem seal (Fig. 25).

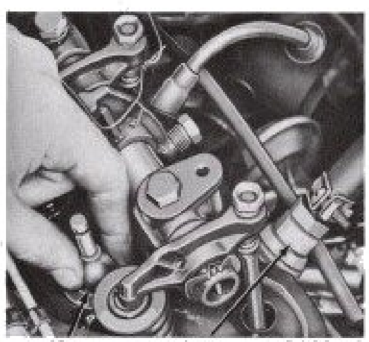

FIG. 25—Valve Stem Seal Removal

8. Install a new valve stem seal. Position the spring over the valve. Install the spring retainer and sleeve. Compress the valve spring and install the valve spring retainer locks.

9. Apply Lubriplate to both ends of the push rod, the valve and push rod ends of the rocker arm, and the valve stem tip. Install the push rod making sure the lower end of the rod is positioned in the valve lifter push rod cup.

10. Remove the wire securing the valve rocker arm and slide the rocker arm into position. If an end valve rocker arm was removed, slide it into position on the shaft and install the spring washer and retaining pin. Turn off the air and remove the air line and adapter. Install the spark plug and spark plug wire.

11. Adjust the valve lash, following the procedure outlined under "Valve Clearance—144, 170 and 200 Six" (Part 8-1, Section 2).

12. Install the valve rocker arm cover, following step 6 under "Valve Rocker Arm Installation".

13. Insert the regulator valve (with the vent hose attached) into the valve rocker arm cover mounting grommet. Install the air cleaner.

CYLINDER FRONT COVER AND TIMING CHAIN

REMOVAL

1. Drain the cooling system and the crankcase. Disconnect the radiator upper hose at the coolant outlet housing and the radiator lower hose at the water pump.

2. Remove the radiator. Remove the drive belt, fan and pulley. Using tool T58P-6316-A, remove the crankshaft damper.

3. Remove the cylinder front cover and gasket. Remove the crankshaft front oil slinger.

4. Rotate the crankshaft in a clockwise direction (as viewed from the front) to take up the slack on the left side of the chain.

5. Establish a reference point on the block and measure from this point to the chain. Rotate the crankshaft in the opposite direction to take up the slack on the right side of the chain. Force the left side of the chain out with the fingers and measure the distance between the reference point and the chain. The deflection is the diffrence between th two measurements. If the deflection extends ½ inch, replace the timing chain and sprockets.

6. Crank the engine until the timing marks are aligned as shown in

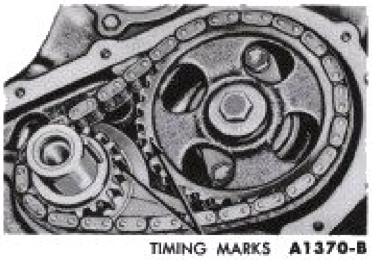

FIG. 26—Aligning Timing Marks

Fig. 26. Remove the camshaft sprocket retaining bolt and washer. Slide both sprockets and timing chain forward and remove them as as assembly (Fig. 27).

7. Remove the oil pan and related parts.

FRONT OIL SEAL REPLACEMENT

It is good practice to replace the oil seal each time the cylinder front cover is removed.

1. Drive out the oil seal with a pin punch. Clean the recess in the cover.

2. Coat a new seal with grease and install the seal. Drive the seal in until it is fully seated in the recess. Check the seal after installation to be sure the spring is properly positioned in the seal.

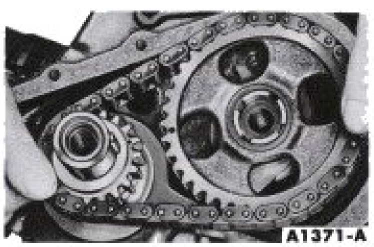

FIG. 27—Timing Chain and Sprockets Removal

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Position the sprockets and timing chain on the camshaft and crankshaft. Be sure the timing marks on the sprockets and chain are positioned as shown in Fig. 26. Install the camshaft sprocket retaining bolt and washer. Torque the bolt to specifications. Install the oil slinger so that the timing pointer on the slinger is aligned with the camshaft timing mark.

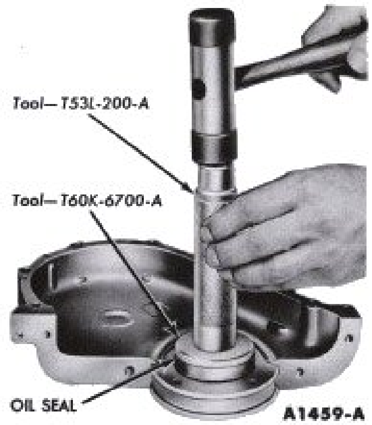

FIG. 28—Crankshaft Front Oil Seal Replacement

2. Clean the cylinder front and the gasket surface of the cylinder block. Apply sealer to a new cylinder front cover gasket and position the gasket on the cylinder front cover. Install the cylinder front cover using the tool shown in Fig. 29. Torque the retaining bolts to specifications.

3. Using tool T52L-6306-AEE, install the crankshaft damper. Torque the retaining bolt to specifications.

4. Install the oil pan and related parts.

5. Install the fan, pulley and drive belt. Adjust the drive belt.

6. Install the radiator. Connect the radiator upper and lower hoses.

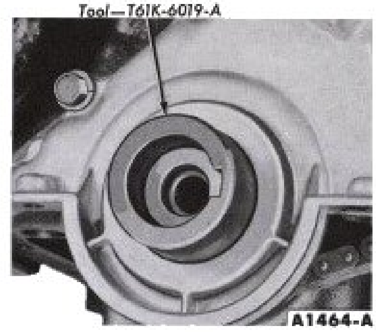

FIG. 29—Cylinder Front Cover Alignment

7. Fill and bleed the cooling system. Fill the crankcase with the proper quantity and grade of engine oil.

8. Start the engine and check the ignition timing. Adjust the ignition timing if necessary. Operate the engine at fast idle and check all hose connections and gaskets for leaks.

CAMSHAFT

The camshaft and related parts are shown in Fig. 30.

REMOVAL

1. Drain the cooling system and the crankcase. Remove the air cleaner.

2. Disconnect the radiator hoses from the coolant outlet housing and the water pump. Remove the radiator. Remove the grille.

3. Disconnect the accelerator rod retracting spring. Disconnect the choke control cable and the accelerator rod from the carburetor.

4. Disconnect the fuel inlet line and the distributor vacuum line from the carburetor.

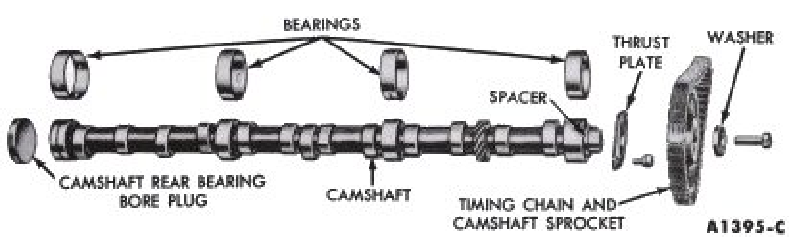

FIG. 30—Camshaft and Related Parts

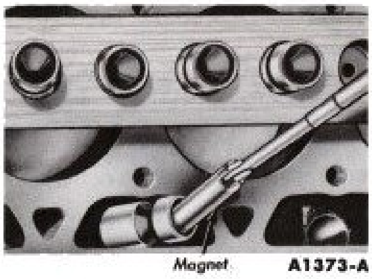

FIG. 31—Valve Lifter Removal

5. Disconnect the coolant hoses from the carburetor spacer.

6. Disconnect the muffler inlet pipe from the exhaust manifold. Pull the muffler inlet pipe down. Remove the gasket.

7. Disconnect the distributor vacuum line from the distributor. Disconnect the carburetor fuel inlet line from the fuel pump. Remove the lines as an assembly.

8. Disconnect the spark plug wires from the spark plugs and the coil high tension lead at the coil. Remove the distributor cap and spark plug wires as an assembly. Disconnect the primary wire from the coil and remove it from the retaining clip on the cylinder head.

9. Disconnect the engine temperature sending unit wire from the sending unit. Disconnect the flexible fuel line from the fuel tank line and plug the line. Remove the distributor, the fuel pump, and the oil filter.

10. Remove the crankcase vent hose, regulator valve, valve rocker arm cover and cylinder head by following steps 8 thru 11 under "Cylinder Head Removal."

11. Using a magnet, remove the valve lifters and keep them in order so that they can be installed in their original location (Fig. 31).

12. Remove the drive belt, fan and pulley. Remove the crankshaft damper using tool T58P-6316-A.

13. Remove the oil level dipstick. Remove the oil pan. Remove the oil pump and inlet tube assembly.

14. Remove the cylinder front cover and gasket. Remove the crankshaft front oil slinger.

15. Push the camshaft toward the rear of the engine. Install a dial indicator so that the indicator point is on the camshaft sprocket cap screw (Fig. 32). Zero the dial indicator. Position a large screw driver between the camshaft sprocket and the block. Pull the camshaft forward and release it. Compare the dial indicator reading with specifications. If the end play is excessive, replace the thrust plate.

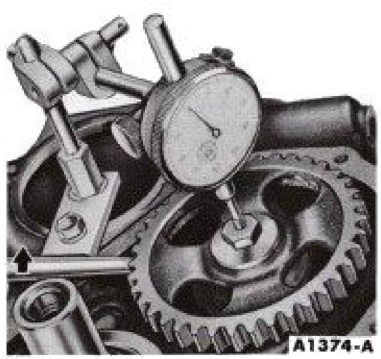

FIG. 32—Camshaft End Play

16. Remove the dial indicator. Remove the timing chain and sprockets folowing steps 4 and 5 under "Cylinder Front Cover and Timing Chain Removal."

17. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. **Use caution to avoid damaging the journals and lobes.**

INSTALLATION

1. Clean the oil passage that feeds the rocker arm shaft by blowing compressed air into the opening in the block. Oil the camshaft and apply Lubriplate to all the camshaft lobes. Carefully slide the camshaft through the bearings.

2. Install the thrust plate and torque the retaining bolts to specifications. Replace the crankshaft front oil seal.

3. Follow steps 1, 2, and 3 under "Cylinder Front Cover and Timing Chain Instalation" and install the sprockets and timing chain, oil slinger, the cylinder front cover and the crankshaft damper.

4. Clean the oil pump inlet tube screen, and oil the pan and block gasket surfaces. Install the oil pump inlet tube, oil pump, and the oil pan and related parts. Install the oil level dipstick.

5. Install the fan and fan pulley and drive belt. Adjust the belt tension. Install the radiator and the grille.

6. Dip the valve lifter foot in Lubriplate. Coat the remainder of each valve lifter with engine oil. Install the valve lifters in their original bores.

7. Install the cylinder head, push rods and the valve rocker arm shaft assembly by following steps 1 thru 9 under "Cylinder Head Installation."

8. Using a new gasket, install the fuel pump and connect the flexible fuel line. Install the oil filter.

9. Position the No. 1 piston at TDC after the compresion stroke. Position the distributor in the block with the rotor at the No. 1 firing position and the breaker points open. Install the distributor hold down clamp.

10. Connect the engine temperature sending unit wire. Connect the coil primary wire. Install the distributor cap. Connect the spark plug wires and the coil high tension lead.

11. Install the distributor vacuum line and the carburetor fuel inlet line.

12. Connect the radiator upper and lower hoses. Connect the coolant hoses to the carburetor spacer.

13. Connect the accelerator rod retracting spring. Connect the choke control cable and the accelerator rod at the carburetor. Adjust the choke control cable.

14. Fill and bleed the cooling system. Fill the crankcase.

15. Start the engine and check and adjust the ignition timing. Check for coolant and oil leaks. Adjust the engine idle speed and the idle fuel mixture.

CAMSHAFT REAR BEARING BORE PLUG REPLACEMENT

1. On a car with a manual-shift transmission, slide the transmission to the rear and remove the clutch pressure plate and disc following the procedure in Group 5.

On a car with automatic transmission, remove the transmission and converter housing following the procedure in Group 7.

2. Remove the flywheel retaining bolts and remove the flywheel.

3. Drill a ½-inch hole in the camshaft rear bearing bore plug and use tool T58L-101-A to remove the plug (Fig. 54).

4. Clean out the plug bore recess thoroughly.

5. Coat the flange of a new plug with water resistant sealer and install it with the flange facing out and slightly below the chamfer in the bore (Fig. 56).

6. Apply oil-resistant sealer to the flywheel bolts and install the flywheel.

On a car with a manual-shift transmision, install the clutch pressure plate, disc, and transmision following the procedure in Group 5.

On a car with automatic transmission install the transmission and converter housing following the procedure in Group 7.

HYDRAULIC VALVE LIFTER

REPLACEMENT

1. Remove the cylinder head and related parts following the procedure under "Cylinder Head Removal."

2. Using a magnet, remove the valve lifters (Fig. 31). Place the lifters in a rack so they can be installed in their original positions.

If the lifters are stuck in their bores by excessive varnish or gum, it may be necessary to use a plier-type tool to remove the lifters. Rotate the lifter back and forth to loosen it from the gum and varnish which may have formed on the lifter.

The internal parts of each hydraulic valve lifter assembly are matched sets. Do not intermix the parts. Keep the assemblies intact until they are to be cleaned.

3. Install new (or cleaned) hydraulic valve lifters through the push rod openings with a magnet (Fig. 31).

4. Install the cylinder head and related parts.

DISASSEMBLY

Each valve lifter is a matched assembly; therefore, the parts are not interchangeable. Disassemble and assemble each lifter carefully, keeping the assemblies in proper sequence so they will be installed in their original bores.

1. Grasp the lock ring with needle nose pliers to release it from the groove. It may be necessary to depress the plunger to fully release the lock ring.

2. Remove the push rod cup, plunger and spring.

3. Invert the plunger assembly and remove the check valve retainer by carefully prying up on it with a screwdriver. Remove the check valve and spring.

ASSEMBLY

A typical hydraulic valve lifter assembly is shown in Fig. 33.

1. Place the plunger upside down on a clean work bench.

2. Place the check valve in position over the oil hole on the bottom of the plunger. Set the check valve spring on top of the check valve.

3. Position the check valve retainer over the check valve and spring and push the retainer down into place on the plunger.

4. Place the plunger spring and then the plunger (open end up) into the tappet body.

5. Place the push rod seat in the plunger.

6. Depress the plunger and position the closed end of the lock ring in the lifter body groove. Release the plunger; then depress it again to fully seat the lock ring.

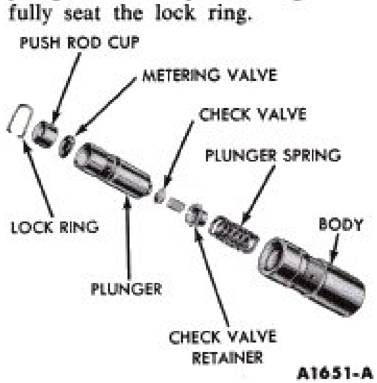

FIG. 33—Valve Lifter Assembly—Typical

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

MAIN AND CONNECTING ROD BEARING REPLACEMENT

The main and connecting rod bearing inserts are selective fit. **Do not file or lap bearing caps or use bearing shims to obtain the proper bearing clearance.**

Selective fit bearings are available for service in standard sizes only. Standard bearings are divided into two sizes and are identified by a daub of red or blue paint. Refer to the Parts Catalog for the available sizes. **Red marked bearings increase the clearance; blue marked bearings decrease the clearance.** Undersize bearings, which are not selective fit, are available for use on journals that have been refinished.

MAIN BEARING

1. Drain the crankcase. Remove the oil level dipstick. Remove the oil pan and related parts.

2. Remove the oil pump inlet tube assembly and the oil pump.

3. Replace one bearing at a time, leaving the other bearings securely fastened. Remove the main bearing cap to which new bearings are to be installed.

4. Insert the upper bearing removal tool (tool 6331) in the oil hole in the crankshaft.

5. Rotate the crankshaft in the direction of engine rotation to force the bearing out of the block.

6. Clean the crankshaft journal. **When replacing standard bearings with new bearings, it is good practice to first try to obtain the proper clearance with two blue bearing halves.**

7. To install the upper main bearing, place the plain end of the bearing over the shaft on the locking tang side of the block and partially install the bearing so that tool 6331 can be inserted in the oil hole in the crankshaft. With tool 6331 positioned in the oil hole in the crankshaft, rotate the crankshaft in the opposite direction of engine rotation until the bearing seats itself. Remove the tool.

8. Replace the cap bearing.

9. Support the crankshaft so that its weight will not compress the Plastigage used in Step 10 and pro-

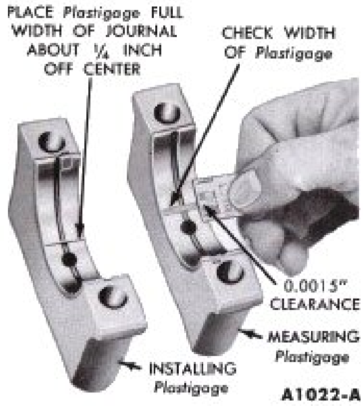

FIG. 34—Installing and Measuring Plastigage—Engine Installed

vide an erroneous reading. Position a jack so that it will bear against the counterweight adjoining the bearing which is being checked.

10. Place a piece of Plastigage on the bearing surface the full width of the bearing cap and about ¼-inch off center (Fig. 34).

11. Install the cap and torque the bolts to specifications. **Do not turn the crankshaft while the Plastigage is in place.**

12. Remove the cap. Using the Plastigage scale, check the width of the Plastigage. **When checking the width of the Plastigage, check at the widest point in order to get the minimum clearance. Check at the narrowest point in order to get the maximum clearance. The difference between the two readings is the taper.**

13. If the clearance is less than the specified limits, try two red bearing halves or a combination of red and blue, depending upon the condition. If the standard bearings do not bring the clearance within the desired limits, refinish the crankshaft journal, then install undersize bearings.

14. If the rear main bearing is replaced, replace the lower oil seal in the rear main bearing cap as follows:

Remove and discard the rear seal.

Clean the mating surfaces of the block and rear main bearing cap, and the rear journal oil seal groove. Preform the new seal by hand to the approximate radius of the cap.

Insert the seal in the oil seal groove, seating the center of the seal first with the seal extending equally on both ends. Press the seal down

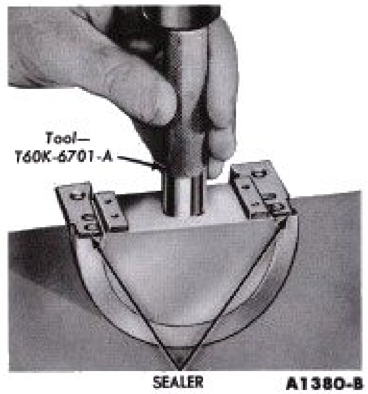

FIG. 35—Seal to Rear Bearing Cap Installation

firmly with the thumb at the center of the seal, then press both ends of the seal into the groove working from the ends to the center.

Position the seal forming tool as shown in Fig. 35 and complete the seal installation. After installation, cut the ends of the seal flush.

Apply a thin coating of oil resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 35). **Do not apply sealer to the area forward of the oil slinger groove.**

The upper oil seal in the block cannot be replaced with the crankshaft installed.

15. After the bearing has been fitted, apply a light coat of engine oil to the journal and bearings, then install the bearing cap. Torque the cap bolts to specifications.

16. Repeat the procedure for the remaining bearings that require replacement.

17. If the thrust bearing cap (No. 3 main bearing) has been removed, install it as follows:

Install the thrust bearing cap with the bolts finger-tight. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 52). Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 52). This will align the thrust surfaces of both halves of the bearing. Retain the forward pressure on the crankshaft. Torque the cap bolts to specifications (Fig. 52).

18. Clean the oil pump inlet tube screen. Install the oil pump and the inlet tube asembly.

19. Position the oil pan gaskets on the oil pan. Position the oil pan front seal on the cylinder front cover. Position the oil pan rear seal on the rear main bearing cap. Install the oil pan and related parts. Install the oil level dipstick.

20. Fill the crankcase. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil leaks.

21. Check and adjust the ignition timing.

CONNECTING ROD BEARING

1. Follow steps 1 and 2 under "Main Bearing Replacement."

2. Turn the crankshaft until the connecting rod to which new bearings are to be fitted is down. Remove the connecting rod cap. Remove the bearing inserts from the rod and cap.

3. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure.

4. Clean the crankshaft journal. **When replacing standard bearings with new bearings, it is good practice to first try to obtain the proper clearance with two blue bearing halves.**

5. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slot provided.

6. Pull the connecting rod assembly down firmly on the crankshaft journal.

7. Place a piece of Plastigage on the lower bearing surface, the full width of the cap and about ¼ inch off center.

8. Install the cap and torque the connecting rod nuts to specification. **Do not turn the crankshaft while the Plastigage is in place.**

9. Refer to steps 12 and 13 under "Main Bearing Replacement."

10. After the bearing has been fitted, clean and apply a light coat of engine oil to the journal and bearings. Install the connecting rod cap. Torque the nuts to specifications.

11. Repeat the procedure for the remaining connecting rods that require new bearings.

12. Follow steps 18 thru 21 under "Main Bearing Replacement."

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

PISTONS AND CONNECTING RODS

REMOVAL

1. Drain the cooling system and the crankcase.

2. Refer to "Cylinder Head Removal" and remove the cylinder head and related parts.

3. Remove the oil pan and related parts. Remove the oil pump inlet tube and the oil pump.

4. Turn the crankshaft until the piston to be removed is at the bottom of its travel and place a cloth on the piston head to collect the cuttings. Remove any ridge and/or deposits from the upper end of the cylinder bores. Remove the cylinder ridge with a ridge cutter. Follow the instructions furnished by the tool manufacturer. **Never cut into the ring travel area in excess of 1/32 inch when removing ridges.**

5. Make sure all the connecting rod caps are marked so that they can be installed in their original positions. Remove the connecting rod cap.

6. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a hammer. Avoid damage to the crankpin or the cylinder wall when removing the piston and rod.

INSTALLATION

1. Clean the oil pump inlet tube screen, and the oil pan and block gasket surfaces.

2. Oil the piston rings, pistons and cylinder walls with light engine oil.

3. Be sure to install the pistons in the same cylinders from which they were removed, or to which they were fitted. The conecting rod and bearing caps are numbered from 1 to 6 beginning at the front of the engine. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever transposed from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder.

4. Make sure the ring gaps are properly spaced around the circumference of the piston. Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Fig. 36). Be sure

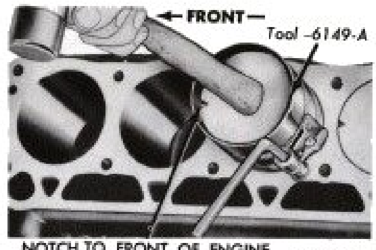

FIG. 36—Piston Installation

to guide the connecting rods to avoid damaging the crankshaft journals. **Install the piston with the notch in the piston head toward the front of the engine.**

5. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement."

6. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

7. Turn the crankshaft throw to the bottom of its stroke, then push the piston all the way down until the connecting rod bearing seats on the crankshaft journal. Install the connecting rod cap. Torque the nuts to specifications.

8. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each crankshaft journal (Fig. 37).

9. Install the oil pump and the oil pump inlet tube. Install the oil pan and related parts.

10. Install the cylinder head by following steps 1 through 17 under "Cylinder Head Installation."

11. Fill the crankcase.

12. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil and coolant leaks.

13. Check and adjust the ignition timing, engine idle speed and the fuel mixture.

14. Install the air cleaner.

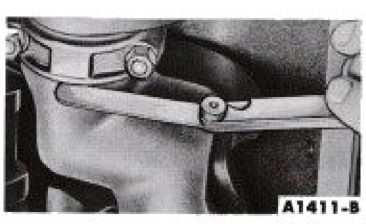

FIG. 37—Connecting Rod Side Clearance

DISASSEMBLY

1. Remove the bearing inserts from the connecting rod and cap.

2. Mark the pistons and pins to assure assembly with the same rod and installation in the same cylinders from which they were removed.

3. Remove the piston pin from the piston and connecting rod (Fig. 38). Remove the piston rings.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

To fit new pistons, pins or rings, refer to Part 8-1, Section 2.

ASSEMBLY

The piston, connecting rod, and related parts are shown in Fig. 39. **Check the fit of a new piston in the cylinder bore before assembling the piston and piston pin to the connecting rod.**

The piston pin bore of a connecting rod and the diameter of the piston pin must be within specifications. Refer to Part 8-4.

1. Apply a light coat of engine oil to all parts. **Assemble the piston to the connecting rod with the oil squirt hole in the connecting rod and the indentation in the piston positioned as shown in Fig. 40.**

2. Start the piston pin in the piston and connecting rod. Draw the piston pin through the piston and connecting rod until the end of the pin seats in Detail 2 (Fig. 41).

3. Follow the instructions contained on the piston ring package and install the piston rings.

4. Check the ring side clearance of the compression rings with a feeler gauge. Refer to "Fitting Piston Rings" in Part 8-1, Section 2.

5. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.

FLYWHEEL

REMOVAL

1. On a manual-shift transmission, remove the transmission, clutch pressure plate, and disc following the procedures in Group 5.

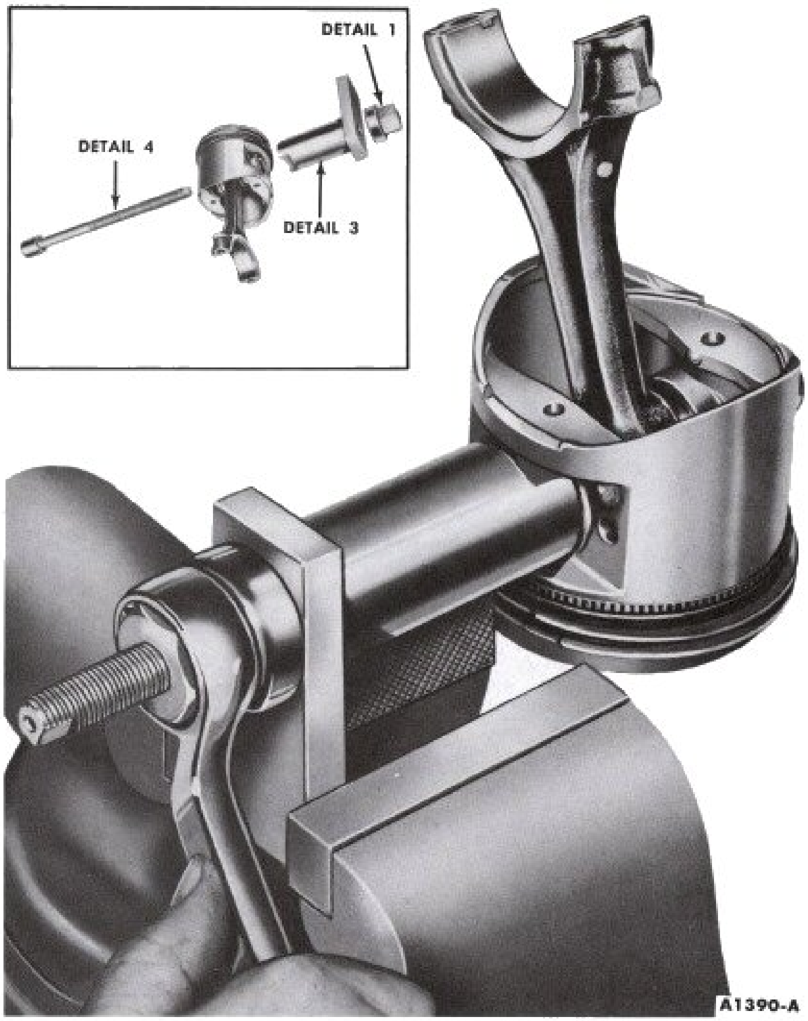

FIG. 38—Piston Pin Removal

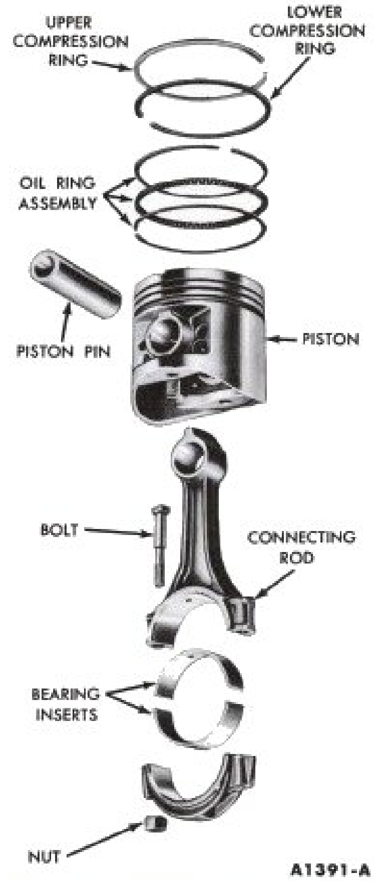

FIG. 39—Piston, Connecting Rod and Related Parts—Typical

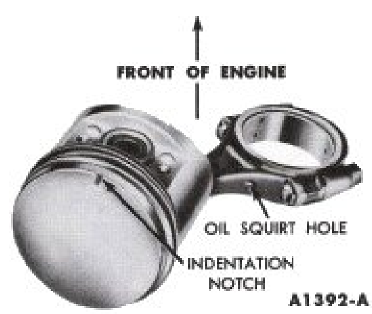

FIG. 40—Piston and Connecting Rod Assembly—Typical

On a car with automatic transmission, remove the transmission and converter housing following the procedure in Group 7.

2. Remove the flywheel retaining bolts and remove the flywheel.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

To check flywheel face runout refer to Part 8-1, Section 1.

INSTALLATION

1. Position the flywheel on the crankshaft flange. Apply sealer to the retaining bolts. Install and torque the bolts in sequence across from each other to specifications.

2. On a manual-shift transmision, install the clutch pressure plate, disc, and the transmission following the procedures in Group 5.

On a car with automatic transmission, install the converter housing and transmission following the procedure in Group 7.

CLUTCH PILOT BUSHING REPLACEMENT

Inspection procedures are outlined under "Flywheel Cleaning and Inspection" in Part 8-1, Section 3.

1. Remove the transmission, clutch pressure plate, and disc following the procedures in Group 5.

2. Using tools T59L-100-B and T58L-101-A, remove the pilot bushing (Fig. 42).

3. Coat the pilot bushing bore in the crankshaft with a small quantity of wheel bearing lubricant. **Avoid using too much lubricant as it may be thrown onto the clutch disc when the clutch revolves.**

4. Using tool T52T-12175-AJD, install the pilot service bearing (Fig. 43).

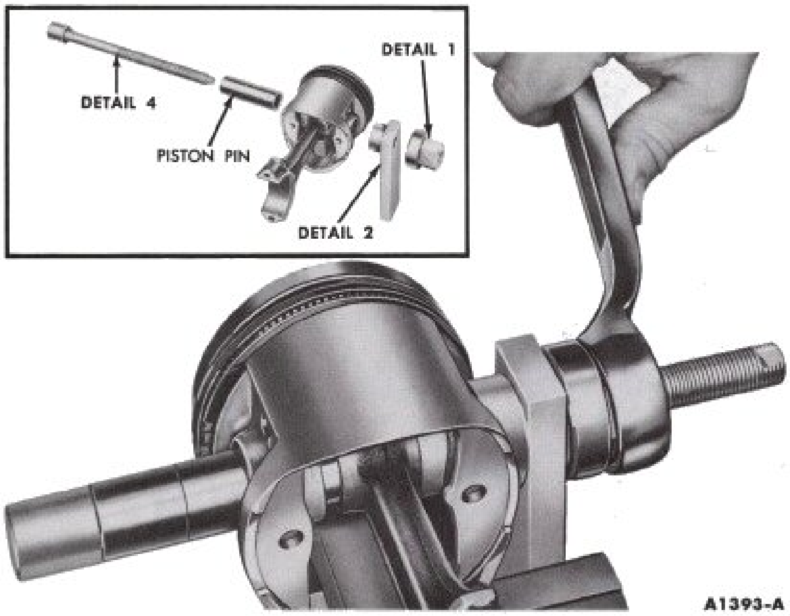

FIG. 41—Piston Pin Installation

5. Install the clutch pressure plate, disc, and the transmission following the procedures in Group 5.

OIL FILTER REPLACEMENT

1. Place a drip pan under the filter. Unscrew the filter from the adapter fitting. Clean the adapter filter recess.

2. Coat the gasket on the replacement filter with oil. Position the filter on the adapter fitting. Hand tighten the filter until the gasket contacts the adapter face, then advance it ½ turn.

3. Operate the engine at fast idle, and check for oil leaks. If oil leaks are evident, perform the necessary repairs to correct the leakage. Check the oil level and fill the crankcase if necessary.

OIL PAN

REMOVAL

1. Drain the crankcase.

2. Remove the oil level dipstick and the flywheel housing inspection cover.

3. Remove the oil pan and gasket.

4. Remove the oil pump inlet tube and screen assembly.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Clean and install the oil pump inlet tube and screen assembly (Fig. 44).

2. Clean the gasket surfaces of the block and oil pan. The oil pan has a two-piece gasket. Coat the block surface and the oil pan gasket surface with sealer. Position the oil pan gaskets on the cylinder block (Fig. 45).

3. Position the oil pan front seal on the cylinder front cover (Fig. 45). **Be sure the tabs on the seal are over the oil pan gasket.**

4. Position the oil pan rear seal on the rear main bearing cap (Fig. 45). **Be sure the tabs on the seal are over the oil pan gasket.**

5. Hold the oil pan in place against the block and install a bolt, finger-tight, on each side of the oil pan. Install the remaining bolts. Torque the bolts from the center outward in each direction to specifications.

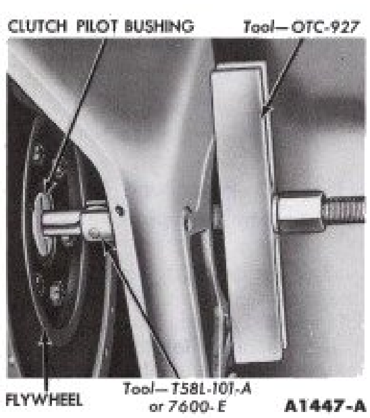

FIG. 42—Clutch Pilot Bushing Removal

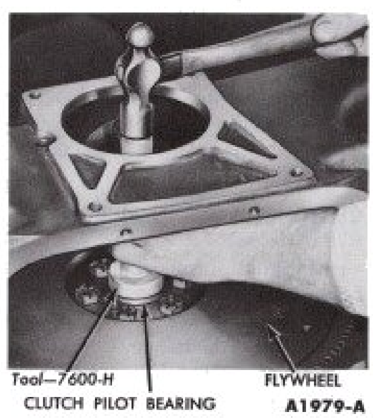

FIG. 43—Clutch Pilot Service Bearing Installation

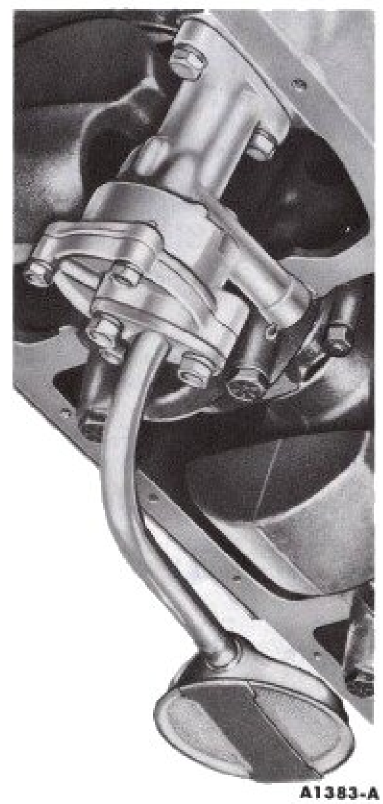

FIG. 44—Oil Pump Inlet Tube Installed

6. Install the oil level dipstick. Fill the crankcase with the proper grade and quantity of engine oil.

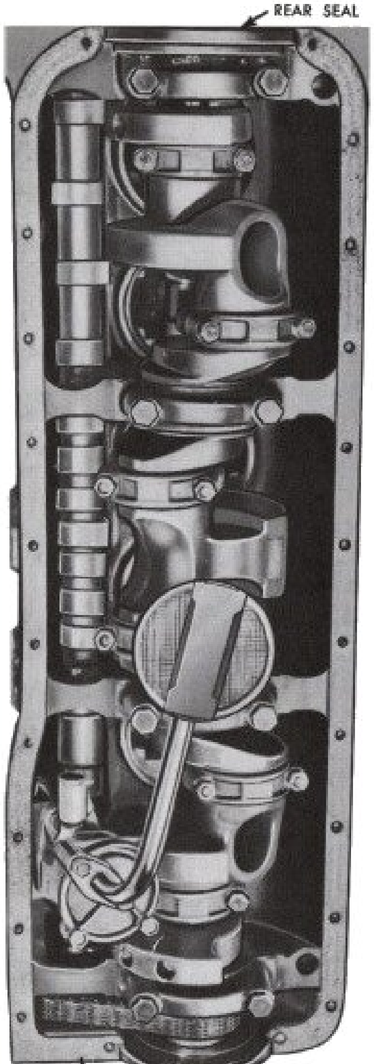

FIG. 45—Oil Pan Gasket and Seals Installed

Operate the engine and check for oil leaks.

OIL PUMP

REMOVAL

1. Remove the oil pan and related parts as outlined under "Oil Pan Removal."

2. Remove the oil pump retaining bolts and remove the oil pump, gasket, and intermediate drive shaft.

INSTALLATION

1. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.

2. Position the intermediate drive shaft into the distributor socket. With the shaft firmly seated in the distributor socket, the stop on the shaft should touch the roof of the crankcase. Remove the shaft and position the stop as necessary.

3. Position a new gasket on the pump housing. With the stop properly positioned, insert the intermediate drive shaft into the oil pump. Install the pump and shaft as an assembly. **Do not attempt to force the pump into position if it will not seat readily. The drive shaft hex may be misaligned with the distributor shaft. To align, rotate the intermediate drive shaft into a new position.** Torque the oil pump retaining screws to specifications.

4. Install the oil pan and related parts as outlined under "Oil Pan Installation."

DISASSEMBLY

1. Remove the oil inlet tube from the oil pump and remove the gasket.

2. Remove the cover retaining screws, and remove the cover. Remove the inner rotor and shaft assembly, and remove the outer race.

3. Insert a self-threading sheet metal screw of the proper diameter into the oil pressure relief valve chamber cap and pull the cap out of the chamber. Remove the spring and plunger.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

ASSEMBLY

The oil pump assembly is shown in Fig. 46.

1. Oil all parts thoroughly.

2. Install the oil pressure relief valve plunger, spring, and a new cap.

3. Install the outer race, and the inner rotor and shaft assembly. **The inner rotor and shaft, and the outer race are serviced as an assembly. One part should not be replaced without replacing the other.** Install the cover and torque the cover retaining screws to specifications.

4. Position a new gasket and the oil inlet tube on the oil pump and install the retaining bolts.

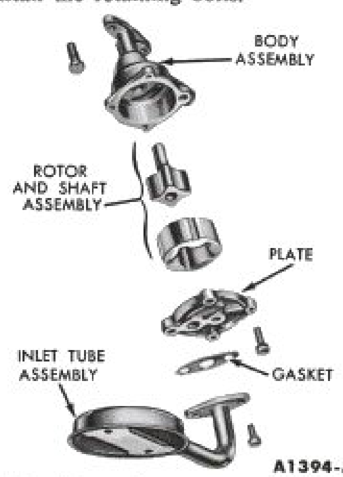

FIG. 46—Oil Pump Assembly

3 ENGINE REMOVAL AND INSTALLATION

REMOVAL

1. Remove the hood.

2. Drain the cooling system and the crankcase.

3. Remove the air cleaner. Disconnect the battery ground cable at the cylinder head. Disconnect the radiator upper hose at the water outlet housing and the radiator lower hose at the water pump.

4. Remove the radiator. Remove the drive belt, fan, and pulley.

5. Disconnect the heater hoses from the water pump and the carburetor spacer. Disconnect the generator or alternator wires from the generator or alternator, the starter cable from the starter, the accelerator rod and the choke control cable from the carburetor.

6. Disconnect the windshield wiper vacuum hose at the vacuum pump. Remove the fuel pump sediment bowl. Disconnect the flexible fuel line at the fuel tank line and plug the fuel tank line.

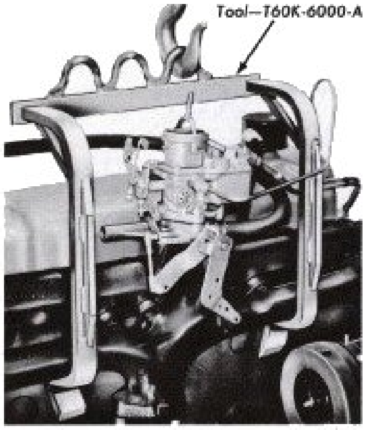

FIG. 47—Engine Lifting Hook

7. Disconnect the coil primary wire at the coil. Disconnect the oil pressure and the water temperature sending unit wires at the sending units.

8. Remove the starter and dust seal.

On a car with a manual-shift transmission, disconnect the clutch retracting spring. Disconnect the clutch equalizer shaft and arm bracket at the underbody rail and remove the arm bracket and equalizer shaft.

9. Raise the car. Remove the flywheel or converter housing upper retaining bolts through the access holes in the underbody.

10. Disconnect the muffler inlet pipe at the exhaust manifold. Loosen the inlet pipe clamp and slide it off the support bracket on the engine. Disconnect the engine right and left mount at the underbody bracket. Remove the flywheel or converter housing cover.

On a car with a manual-shift transmission, remove the flywheel housing lower retaining bolts.

On a car with automatic transmission, disconnect the converter from the flywheel. Remove the converter housing lower retaining bolts.

11. Lower the car. Support the transmission and flywheel or converter housing with a jack.

12. Attach the engine lifting hook (Fig. 47). Carefully lift the engine

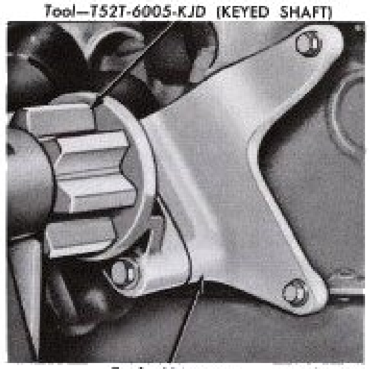

FIG. 48—Engine Work Stand

out of the engine compartment. Install the engine on a work stand (Fig. 48).

INSTALLATION

1. Install guide pins in the flywheel or converter housing bolt holes in the rear of the engine. Place a new gasket over the studs of the exhaust manifold.

2. Carefully lower the engine into the engine compartment.

3. Make sure the studs on the exhaust manifold are aligned with the holes in the muffler inlet pipe and the guide pins in the block engage the holes in the flywheel housing.

On a car with automatic transmission, start the converter pilot into the crankshaft.

On a car with a manual-shift transmission, start the transmission main drive gear into the clutch disc. It may be necessary to adjust the position of the transmission in relation to the engine if the input shaft will not enter the clutch disc. **If the engine "hangs up" after the shaft enters, turn the crankshaft slowly (transmission in gear) until the shaft splines mesh with the clutch disc splines.**

4. Remove the engine lifting hooks. Install the flywheel or converter housing upper retaining bolts.

5. Remove the jack from the transmission. Raise the car.

6. Remove the guide pin and install the flywheel or converter housing lower retaining bolts.

On a car with automatic transmission, attach the converter to the flywheel and torque the retaining nuts to specifications.

7. Install the flywheel or converter housing dust cover.

On a car with a manual-shift transmission, install the clutch equalizer shaft and arm bracket. Connect the clutch retracting spring.

8. Install the engine left and right mount to the underbody bracket. Install the sediment bowl on the fuel pump.

9. Remove the plug from the fuel tank line and connect the flexible fuel line to the fuel tank line. Install the exhaust manifold to muffler inlet pipe retaining lock washers and nuts. Torque the nuts to specifications. Position the inlet pipe clamp on the support bracket on the engine and tighten the clamp.

10. Lower the car. Connect the oil pressure and the engine temperature sending unit wires. Connect the coil primary wire. Connect the windshield wiper vacuum hose to the vacuum pump. Connect the accelerator rod. Connect and adjust the choke control cable.

11. Install the starter motor and dust seal. Connect the starter cable. Connect the generator or alternator wires. Connect the heater hose at the water pump and carburetor spacer. Connect the battery ground cable.

12. Install the pulley, fan, and drive belt. Adjust the drive belt tension. Install the radiator. Connect the radiator upper and lower hoses. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of engine oil.

13. Install and adjust the hood.

14. Operate the engine at fast idle and check all gaskets and hose connections for leaks.

On a car with automatic transmission, adjust the transmission control linkage.

15. Install the air cleaner.

4 MAJOR REPAIR OPERATIONS

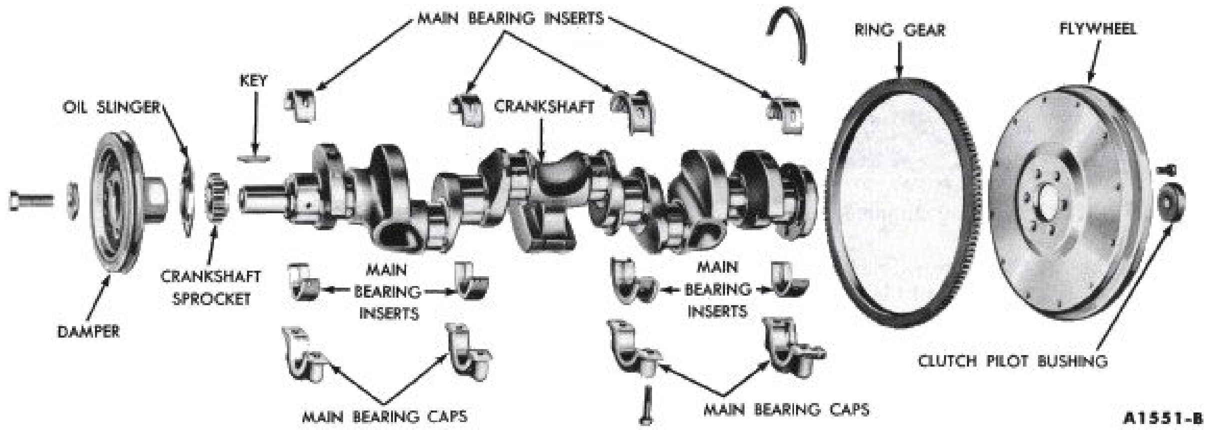

FIG. 49—Crankshaft and Related Parts—Typical

To perform the operations in this section, it will be necessary to remove the engine from the car and install it on a work stand.

CRANKSHAFT

REMOVAL

The crankshaft and related parts are shown in Fig. 49.

1. Loosen the generator or alternator adjusting bolts and remove the fan belt. Remove the oil level dipstick.

2. Remove the crankshaft pulley retaining bolt and washer. Remove the crankshaft pulley. If equipped with a crankshaft vibration damper, remove the damper using tool T58P-6316-A.

3. Remove the cylinder front cover and gasket.

4. Remove the oil slinger. Check the timing chain deflection, then remove the timing chain and sprockets by following steps 4 and 5 under "Cylinder Front Cover and Timing Chain Removal."

5. Invert the engine on the work stand. Remove the flywheel. Remove the oil pan and gasket. Remove the oil pump.

6. Make sure all bearing caps (main and connecting rod) are marked so that they can be installed in their original locations. Turn the crankshaft until the connecting rod from which the cap is being removed is down. Remove the connecting rod cap. Push the connecting rod and piston assembly up in the cylinder.

7. Remove the main bearing caps.

8. Carefully lift the crankshaft out of the block so that the thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

INSTALLATION

1. Remove the rear journal oil seal from the block and rear main bearing cap.

2. Remove the main bearing inserts from the block and bearing caps.

3. Remove the connecting rod bearing inserts from the connecting rods and caps.

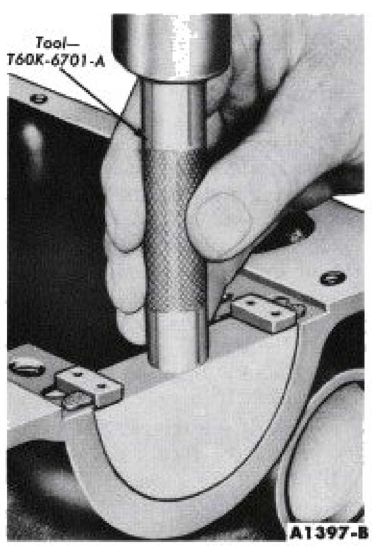

FIG. 50—Rear Oil Seal to Block Installation

4. Clean the rear journal oil seal grooves. Install a new rear journal oil seal in the block (Fig. 50) and rear main bearing cap (Fig. 35). After installation, cut the ends of the seals flush.

5. Apply a thin coating of oil resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 35). **Do not apply sealer to the area forward of the oil slinger groove.**

6. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing inserts and bearing bores are clean. Foreign material under the inserts may distort the bearing and cause a failure.

7. Place the upper main bearing inserts in position in the bores with the tang fitting in the slot provided.

8. Install the lower main bearing inserts in the bearing caps.

9. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**

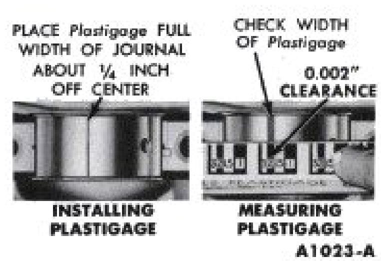

FIG. 51—Installing and Measuring Plastigage—Engine on Work Stand

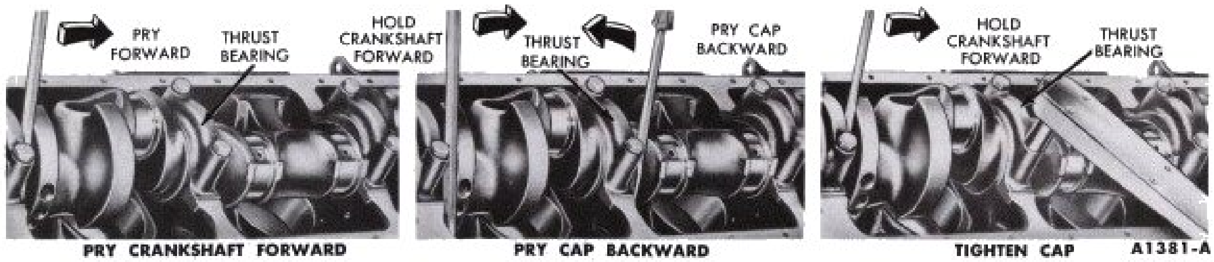

FIG. 52—Thrust Bearing Alignment

10. Check the clearance of each main bearing. Place a piece of Plastigage on the crankshaft journal the full width of the journal and about ¼ inch off center (Fig. 51). Follow steps 11 thru 13 under "Main Bearing Replacement."

11. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install all the bearing caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original locations.** Torque the bearing cap bolts to specifications.

12. Install the thrust bearing cap with the bolts finger-tight.

13. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 52).

14. Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 52). This will align the thrust surfaces of both halves of the bearing.

15. Retain the forward pressure on the crankshaft. Torque the cap bolts to specifications (Fig. 52).

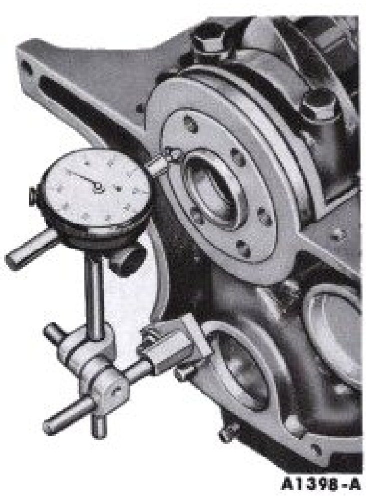

FIG. 53—Crankshaft End Play

16. Force the crankshaft toward the rear of the engine.

17. Install a dial indicator so that the contact point rests against the crankshaft flange and the indicator axis is parallel to the crankshaft axis (Fig. 53).

18. Zero the dial indicator. Push the crankshaft forward and note the reading on the dial.

19. If the end play exceeds the wear limit (0.012 inch), replace the thrust bearing. If the end play is less than the minimum limit, inspect the thrust bearing faces for scratches, burrs, nicks, or dirt. If the thrust faces are not defective or dirty, they probably were not aligned properly. Install the thrust bearing and align the faces following the recommended procedure (steps 12, 13, 14, and 15). Check the end play which should be 0.004-0.008 inch.

20. Install new bearing inserts in the connecting rods and caps. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement."

21. If the bearing clearances are to specifications, apply a light coat of engine oil to the journals and bearings.

22. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the rod bearing seats on the crankshaft journal.

23. Install the connecting rod cap. Torque the nuts to specifications.

24. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each connecting rod crankshaft journal (Fig. 37).

25. Clean the oil pan, oil pump, and oil pump screen.

26. Install the oil pump following steps 1, 2, and 3 under "Oil Pump Installation." Install the oil pan following steps 2 thru 5 under "Oil Pan Installation."

27. Position the flywheel on the crankshaft. Install and torque the retaining bolts to specifications.

On a flywheel for a manual-shift transmission, use tool 7563 to locate the clutch disc. Install the pressure plate.

28. Turn the engine on the work stand so that the front end is up.

29. Install the timing chain and sprockets, cylinder front cover and crankshaft pulley or damper, following steps 1 thru 3 under "Cylinder Front Cover and Timing Chain Installation."

30. Turn the engine on the work stand so that the engine is in the normal position. Install the oil level dipstick. Install and adjust the drive belt.

31. Remove the engine from the work stand and install it in the car.

CAMSHAFT BEARING REPLACEMENT

The bearings are available pre-finished to size and require no reaming for standard and 0.015-inch undersize journal diameters.

1. Remove the flywheel and the camshaft. Remove the rear bearing bore plug (Fig. 54).

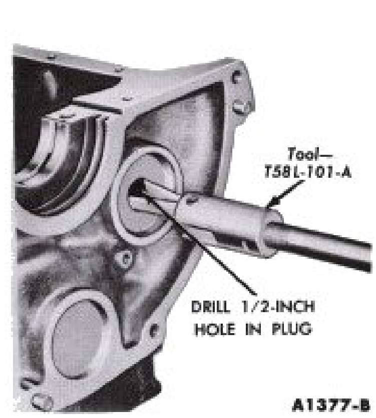

FIG. 54—Camshaft Rear Bore Plug Removal

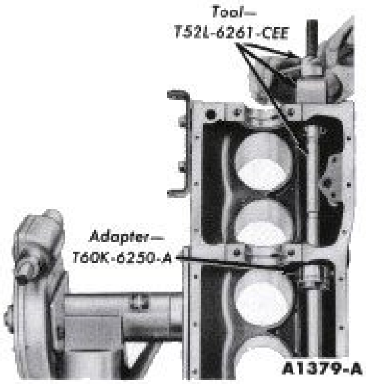

FIG. 55—Camshaft Bearing Removal or Installation

2. Remove the camshaft bearings (Fig. 55).

3. Position the bearings in the bearing bore and press them into place (Fig. 55). **No. 1 camshaft bearing must be pressed in 0.100-0.140 inch below the front face of the bearing bore. Press the remaining bearings in sufficiently to align the oil supply holes. The No. 4 bearing has two oil holes.** Check the oil passage that feeds the rocker arm shaft for obstructions by squirting oil into the opening in the cylinder block and observing the flow through the oil hole at No. 4 camshaft bearing.

4. Clean the camshaft rear bearing bore plug recess thoroughly. Install a new plug (Fig. 56).

5. Install the camshaft and related parts.

6. Install the engine in the car.

ENGINE DISASSEMBLY

1. Disconnect the distributor vacuum line and the fuel inlet line at the carburetor. Disconnect the vacuum line at the carburetor spacer or intake manifold.

2. Disconnect the vacuum line at the fuel pump and the carburetor fuel inlet line at the fuel filter. Disconnect the distributor vacuum line at the distributor. Remove the fuel inlet line, distributor vacuum line, and the intake manifold vacuum line as an assembly.

3. Remove the positive crankcase ventilation system by following the procedures under "Positive Crankcase Ventilation System Removal" in Section 2 of this part of the manual.

4. Remove the carburetor and gasket. Remove the exhaust manifold.

5. Remove the coil. Remove the distributor cap and spark plug wires as an assembly. Remove the distributor, fuel pump, and oil filter. Remove the spark plugs.

6. Remove the valve rocker arm cover. Remove the valve rocker arm shaft assembly (Fig. 16) by removing the support bolts evenly and equally 2 turns at a time.

7. Remove the valve push rods in sequence and identify them so that they can be installed in their original positions (Fig. 17). Using a magnet, remove the valve lifters in sequence (Fig. 31).

8. Remove all cylinder head bolts. Install the cylinder head guide studs (Fig. 18). Lift the cylinder head assembly off the engine. **Do not pry between the head and block as the gasket surfaces may become damaged.**

On a flywheel for a manual-shift transmission, mark the pressure plate cover so that it can be replaced in the same position. Remove the clutch pressure plate and cover assembly.

Remove the flywheel. Remove the clutch pilot bushing (Fig. 42).

9. Remove the oil pan. Discard the gasket and seals.

10. Remove the oil pump and inlet tube assembly. Discard the oil pump gasket.

11. Loosen the generator or alternator mounting bolts and disconnect the generator or alternator adjusting arm at the water pump. Remove the drive belt.

12. Remove the fan and pulley, the generator or alternator, the water pump, and the crankshaft pulley. If equipped with a crankshaft vibration damper, remove the damper using tool T58P-6316-A.

13. Remove the cylinder front cover. Discard the gasket. Remove the crankshaft front oil slinger. Check the camshaft end play by following step 15 under "Camshaft Removal." Check timing chain deflection by following step 4 under "Cylinder Front Cover Removal."

14. Remove the camshaft sprocket retaining bolt and washer. Slide both sprockets and the timing chain forward and remove them as an assembly (Fig. 27).

15. Remove any ridges and/or deposits from the upper end of the cylinder bores. Remove the cylinder ridges with a ridge cutter. Follow the instructions furnished by the tool manufacturer. **Never cut into the ring travel area in excess of 1/32 inch when removing ridges.**

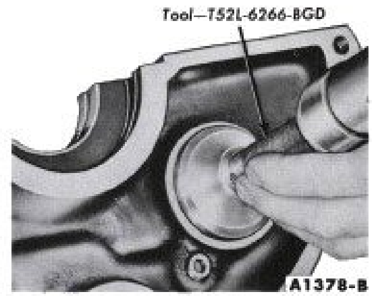

FIG. 56—Camshaft Rear Bore Plug Installation

16. **Make sure all bearing caps (main and connecting rod) are marked so they can be installed in their original locations.** Turn the crankshaft until the connecting rod being removed is down. Remove the connecting rod cap.

17. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a hammer. **Avoid damage to the crankpin or the cylinder wall when removing the piston and rod.**

18. Remove the bearing inserts from the connecting rods and caps. Remove the main bearing caps.

19. Carefully lift the crankshaft out of the cylinder block so that the thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

20. Remove the rear journal oil seal from the block and rear main bearing cap. Remove the main bearing inserts from the block and bearing caps.

21. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. **Use caution to avoid damaging the journals and lobes.**

22. Remove the camshaft rear bearing bore plug (Fig. 54).

23. Remove the camshaft bearings (Fig. 55).

ENGINE ASSEMBLY

1. Install the camshaft bearings and rear bore plug by following

steps 3 and 4 under "Camshaft Bearing Replacement."

2. The camshaft and related parts are shown in Fig. 30. Oil the camshaft and apply Lubriplate to all camshaft lobes. Carefully slide the camshaft through the bearings.

3. Install the thrust plate. Torque the retaining screws to specifications.

4. The crankshaft and related parts are shown in Fig. 49. Be sure that the rear journal oil seal grooves are clean. Install a new rear journal oil seal in the block (Fig. 50) and rear main bearing cap (Fig. 35). After installation, cut the ends of the seals flush.

5. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing bores are clean. Place the upper main bearing inserts in position in the bore with the tang fitting in the slot provided.

6. Install the lower main bearing inserts in the bearing caps.

7. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**

8. Check the clearance of each main bearing following steps 10 thru 13 under "Main Bearing Replacement." In step 10, place the Plastigage on the crankshaft journal instead of in the bearing cap (Fig. 51).

9. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install all the bearing caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original locations.** Torque the bearing cap bolts to specifications.

10. Install the thrust bearing cap by following steps 12 thru 15 under "Crankshaft Installation."

11. Check the crankshaft end play by following steps 17 thru 19 under "Crankshaft Installation."

12. Turn the engine on the work stand so that the front end is up.

13. Oil the piston rings, pistons, and cylinder walls with light engine oil.

14. Be sure to install the pistons in the same cylinders from which they were removed, or to which they were fitted. The connecting rod and bearing cap are numbered from 1 to 6 beginning at the front of the engine. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever transposed from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder number.

15. Make sure the ring gaps are properly spaced around the circumference of the piston.

16. Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Fig. 36). Be sure to guide the connecting rods to avoid damaging the crankshaft journals. **Install the piston with the notch in the piston head toward the front of the engine.**

17. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement."

18. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

19. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the connecting rod bearing seats on the crankshaft journal.

20. Install the connecting rod cap. Torque the nuts to specifications.

21. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each crankshaft journal (Fig. 37).

22. Lubricate the timing chain and sprockets with engine oil. Place the keys in position in the slots on the crankshaft and camshaft.

23. Position the sprockets and timing chain on the camshaft and crankshaft. Be sure the timing marks on the sprockets and chain are positioned as shown in Fig. 26.

24. Install the camshaft sprocket retaining bolt and washer. Torque the bolt to specifications. Install the oil slinger.

25. Install a new crankshaft front oil seal.

26. Clean the cylinder front cover and the gasket surface of the cylinder block.

27. Coat the gasket surface of the block and the cover with sealer. Position a new gasket on the block.

28. Using tool T61K-6019-A, install the cylinder front cover on the block. Torque the screws to specifications.

29. Line up the crankshaft pulley or damper keyway with the key on the crankshaft.

30. Install the crankshaft pulley. If equipped with a crankshaft vibration damper, install the damper using tool T52L-6306-AEE. Torque the retaining bolt to specifications.

31. Install the water pump, generator or alternator, fan pulley, and fan. Install and adjust the drive belt.

32. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.

33. Using a new gasket, install the oil pump. Clean and install the oil inlet tube assembly.

34. Make sure the gasket surfaces of the block and oil pan are clean.

35. Coat the block surface and oil pan gasket surface with sealer and position the gasket on the block (Fig. 45).

36. Install the oil pan front seal on the cylinder front cover and the oil pan rear seal on the rear main bearing cap (Fig. 45). **Be sure the tabs on the seals are over the oil pan gasket.**

37. Position the oil pan on the block. Install the retaining screws. Torque the screws from the center outward in each direction to specifications.

38. Install the clutch pilot bushing (Fig. 43). Position the flywheel on the crankcase and install the retaining bolts. Torque the bolts to specifications.

On a flywheel for a manual-shift transmission, use tool 7563 to locate the clutch disc. Install the pressure plate. Torque the retaining bolts to specifications.

39. Using a new gasket, install the fuel pump.

40. Position the distributor and intermediate drive shaft into the block with the rotor at the No. 1 firing position and the breaker points open. Install the hold down clamp. **Make sure the oil pump intermediate drive shaft is properly seated in the oil pump. It may be necessary to reposition the intermediate shaft in order to engage it in the oil pump.**

41. Install the oil filter assembly.

42. Dip the lifter foot in Lubriplate. Coat the remainder of each valve lifter with engine oil. Install the lifters in their original bores.

43. Clean the head and block gasket surfaces.

44. Inspect the head for any damage and repair as necessary.

45. Apply cylinder head gasket sealer to both sides of a new gasket. Position the gasket over the guide studs on the cylinder block.

46. Lift the cylinder head over the guides and slide it down carefully. Before installing the cylinder head bolts, coat the threads of the end bolts for the right side of the cylinder head with a small amount of water resistant sealer. Install, but do not tighten, two bolts at opposite ends of the head to hold the head and gasket in position. Remove the guides, then install the remaining bolts.

47. The cylinder head bolts are torqued in three progressive steps. Follow the sequence shown in Fig. 19. Torque the bolts to 55 ft-lbs, then torque them to 65 ft-lbs. Finally, torque the bolts to specifications. **After the cylinder head bolts have been torqued to specifications, the bolts should not be disturbed.**

48. Apply Lubriplate to both ends of the push rods. Install the push rods in their proper sequence, positioning the lower end of the rods in the tappet sockets.

49. Apply Lubriplate to the valve tips and the rocker arm pads. Position the valve rocker arm shaft assembly on the head. **Be sure the oil holes in the shaft are facing downward.**

50. Install the valve rocker arm shaft bolts evenly and equally 2 turns at a time until the specified torque is obtained.

51. Refer to Part 8-1, Section 2 and perform a valve adjustment.

52. Clean the valve rocker arm cover and cylinder head gasket surfaces. Coat one side of a new gasket with an oil-resistant sealer and lay the cemented side of the gasket on the cover (Fig. 15). Install the cover making sure the gasket seats evenly around the head. Torque the cover bolts to specifications. Torque the cover bolts to specifications again two minutes later.

53. Install the spark plugs. Install the distributor cap and spark plug wire assembly. Connect the spark plug wires. Install the coil on the block and connect the coil high tension lead.

54. Position the exhaust manifold on the cylinder head. Install the tab washers and bolts. Torque the bolts to specifications. Lock the bolts by bending one tab of the washer over a flat on the bolt.

55. Position the carburetor gasket on the spacer. Install the carburetor.

56. Install the carburetor fuel inlet line, the manifold vacuum line and the distributor vacuum line.

57. Install the positive crankcase ventilation system by following the procedure under "Positive Crankcase Ventilation System Installation" in Section 2 of this part of the manual.

58. Install the engine in the car.

59. Check the ignition timing and adjust if necessary. Adjust the engine idle fuel mixture and idle speed.

PART 8-3 260 AND 289 V-8

1 DESCRIPTION AND OPERATION

The 260 V-8 engine (Figs. 1, 2, 3 and 4) has a piston displacement of 260 cubic inches and a compression ratio of 8.8:1. The patent plate symbol for the engine is "F".

The 289 V-8 engine (Figs. 1, 2, 3 and 4) has a piston displacement of 289 cubic inches and a compression ratio of 9.0:1. The patent plate symbol for the engine is "K". The engine is available in all Comet models.

MANIFOLDS

Coolant flows from the front of the engine through the intake manifold into the heater inlet hose and circulates through the heater. On cars that

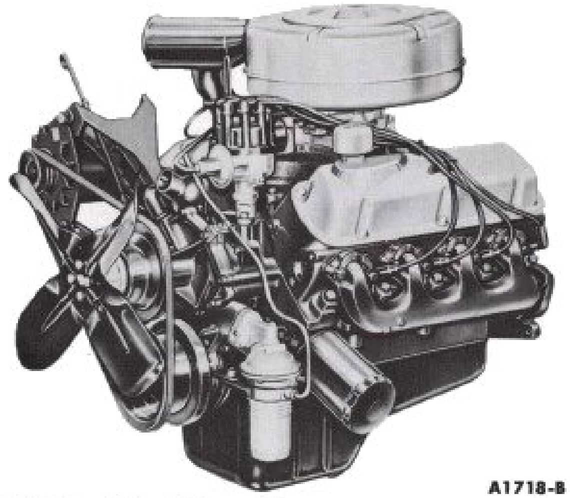

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FIG. 1—¾ Left Front View

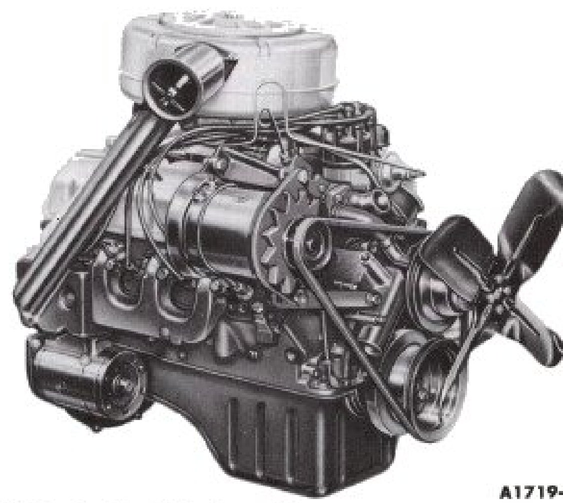

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FIG. 2—¾ Right Front View

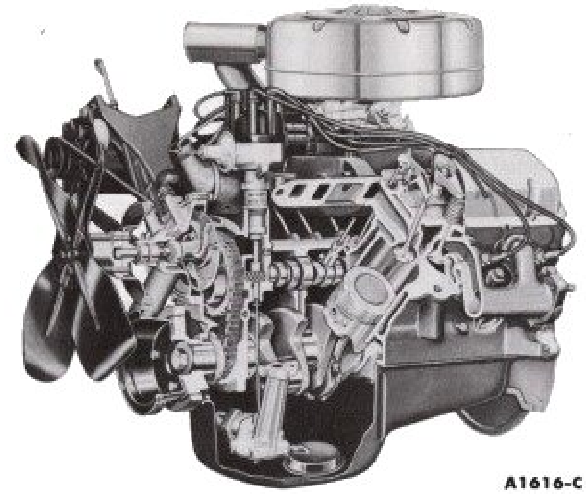

FIG. 3—Front ¾ Sectional View

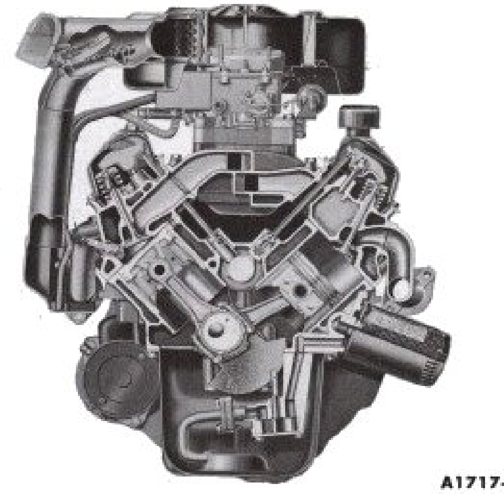

FIG. 4—Front Cross Sectional View

do not have a heater, the coolant is returned to the water pump through a by-pass hose.

Exhaust gases flowing through the crossover passage (Fig. 5) provide the initial heat necessary to assist in vaporizing the incoming fuel mixture.

The intake manifold has two sets of fuel passages, each with its own separate inlet connection to the carburetor (Fig. 6). The right barrel of the carburetor feeds Nos. 1, 4, 6 and 7 cylinders and the left barrel feeds Nos. 2, 3, 5 and 8 cylinders.

Filtered air is drawn from the air cleaner, through an air inlet tube, into the heat chamber in the right exhaust manifold. Here the air is heated and then directed to the automatic choke through the air outlet choke tube (Fig. 7).

CYLINDER HEADS

The cylinder head assemblies contain the valves and the valve rocker arm assemblies. The valve guides and push rod guides are machined in the head with a cast combustion chamber. The valve arrangement from front to rear on the left bank is E-I-E-I-E-I-E-I and on the right bank I-E-I-E-I-E-I-E (Fig. 8).

FIG. 5—Intake Manifold Exhaust Gas Crossover Passage

CYLINDER BLOCK

The cylinders are numbered from front to rear, on the right bank 1, 2, 3 and 4 and on the left bank 5, 6, 7 and 8. The firing order is 1-5-4-2-6-3-7-8.

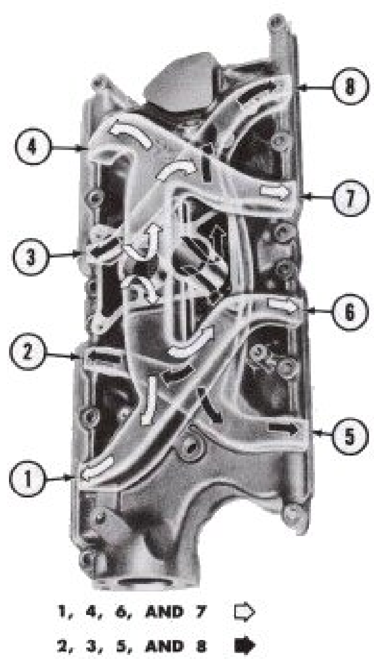

FIG. 6—Intake Manifold Fuel Passages—Typical

The oil pump, mounted inside the oil pan at the left front, is driven by the distributor through an intermediate drive shaft.

The oil filter is mounted on the left lower front of the block.

The crankshaft is supported by five main bearings. Crankshaft end thrust is controlled by the flanges of the No. 3 main bearing.

The pistons have two compression rings and one oil control ring. The top compression ring is chrome-plated and the lower compression ring is phosphate-coated. The oil control ring assembly consists of a serrated spring and two chrome-plated steel rails.

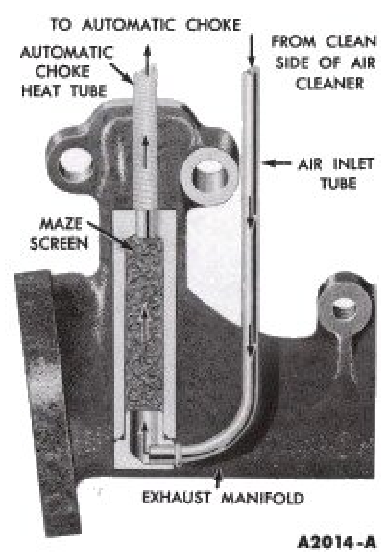

FIG. 7—Automatic Choke Heat Chamber

FIG. 8—Valve Port Arrangement

VALVE TRAIN

The push rods are tubular steel with ball ends. The push rods supply oil from a metering valve (disc) in the hydraulic valve lifters through drilled holes in the ball ends for independent lubrication of each rocker arm.

The rocker arms have a drilled hole in the push rod end for lubrication. They are individually mounted on a stud that is pressed into the cylinder head. A fulcrum seat controls the rocker motion and a nut secures the rocker arm on the stud.

The camshaft is supported by five stepped diameter bearings pressed into the block with a dowel for positioning the camshaft sprocket. It is driven by a sprocket and timing chain in mesh with a sprocket on the crankshaft. Camshaft end play is controlled by a thrust plate attached to the cylinder block. An eccentric, bolted to the front end of the camshaft, operates the fuel pump.

Hydraulic valve lifters are used which provide zero valve lash. The operation and parts identification of the hydraulic valve lifters are shown in Fig. 9.

When the valve is closed, the lifter assembly is on the base circle of the camshaft lobe and the valve push rod is in its lowest position. With the lifter assembly in this position, the plunger spring expands, forcing the plunger upward. This action is transmitted to the valve rocker arm via the valve push rod until there is solid contact between the valve and the valve end of the valve rocker arm (zero valve lash). In this position, the oil hole in the lifter and plunger is indexed with the lifter oil gallery in the cylinder block.

As the lifter plunger moves upward, the volume of the compression chamber is increased, resulting in reduced oil pressure in the compression chamber. Therefore, to equalize the resulting pressure differential between the supply chamber and the compression chamber, the disc valve moves off its seat and permits oil to flow from the supply chamber to the compression chamber. When the compression chamber becomes filled with oil, the pressures in the two chambers are equalized. The oil flow ceases and the disc valve spring seats the disc valve and closes the disc valve port.

As the camshaft rotates, the lifter assembly is raised by the camshaft lobe. This increases the push rod force against the lifter plunger and hydraulic pressure immediately builds up in the compression chamber until it acts as a solid member of the valve operating mechanism. The lifter then becomes a hydraulic ram which forces the valve in the cylinder head to open. During this period, a slight leakage of oil past the plunger occurs (calibrated leak down rate).

As the high point of the camshaft lobe rotates and passes by the foot of the valve lifter, the valve in the cylinder head seats and the valve lifter assembly is forced downward. Reduced force on the lifter plunger at this time relieves the pressure on the lifter plunger and it is free to be moved upward by the plunger spring. This action allows oil to flow once again through the indexed oil holes in the litfer body and plunger.

The operating cycle is completed for each revolution of the camshaft. Zero clearance (lash) in the valve train mechanism is maintained at all times by the hydraulic force and expansion of the plunger spring between the lifter body and plunger.

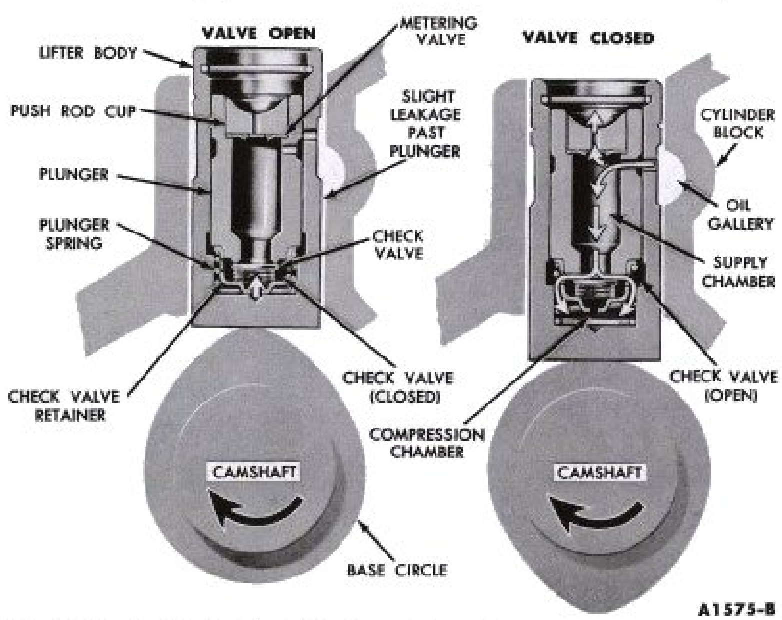

FIG. 9—Typical Hydraulic Valve Lifter Operation

LUBRICATION SYSTEM

Oil from the oil pan sump, located in the front of the oil pan, is forced through the pressure-type lubrication system (Fig. 10) by a rotor oil pump. A spring-loaded relief valve in the pump limits the maximum pressure of the system. Oil relieved by the valve is directed back to the intake side of the pump.

All the oil discharged by the pump passes through an exclusive design full flow-type Rotunda filter before it enters the engine. The filter is mounted at the lower left front of the engine..

On a disposable-type oil filter, a relief valve in the filter permits oil to bypass the filter if the element becomes clogged.

On a replaceable element-type oil filter, a bypass in the center bolt provides oil to the engine in case the filter element becomes clogged. The bypass is located in the hollow center bolt of the filter and consists of a spring-loaded valve. When the element is clean and oil will flow through it, the pressure difference between the inner and outer faces of

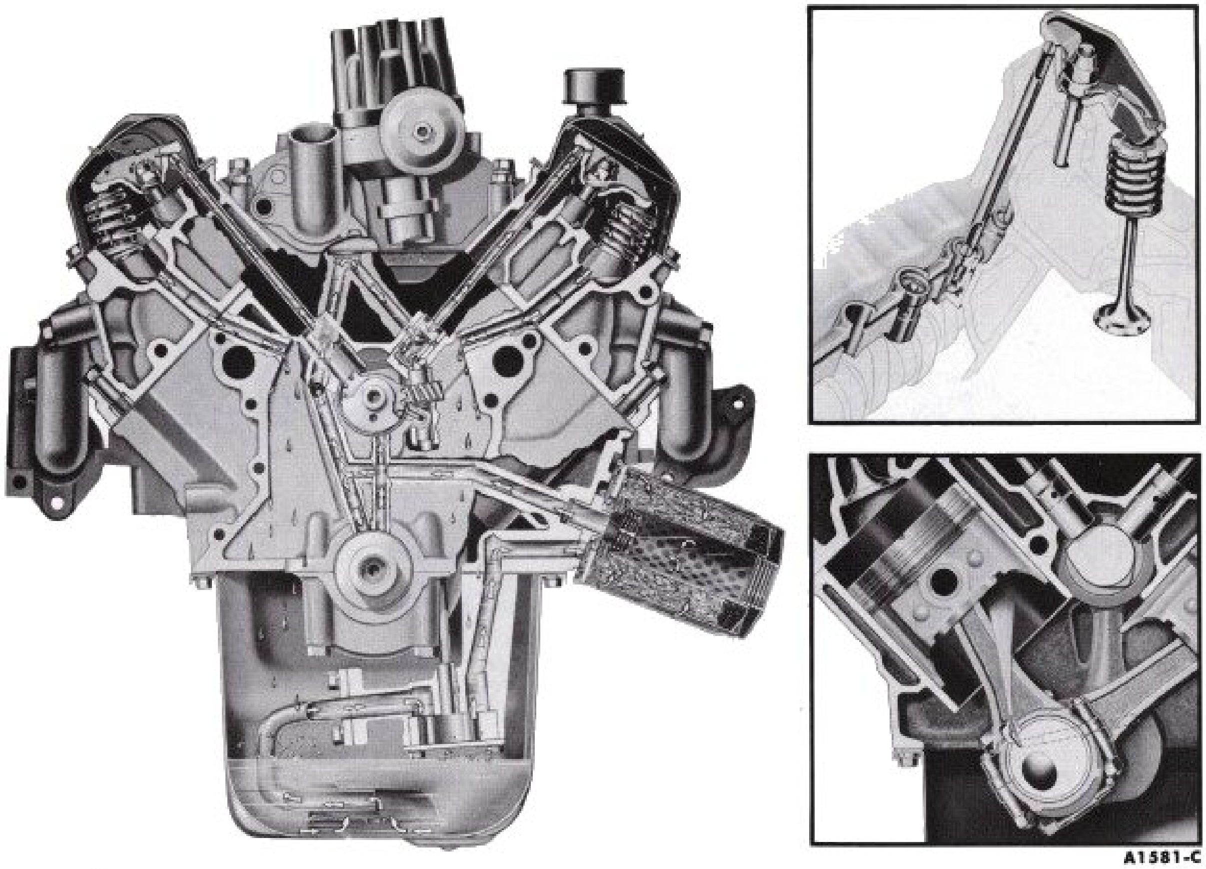

FIG. 10—Lubrication System

the valve is not great enough to overcome the spring pressure behind the valve. Therefore, no oil flows through the bypass. When the element is dirty and will not permit a sufficient flow of oil, the pressure acting on the inner face of the valve drops. If the pressure difference between the valve faces is great enough to overcome spring pressure, the valve will open. Oil then bypasses the element, maintaining an emergency supply of oil to the engine.

From the filter, the oil flows into the main oil gallery which is located to the right side of the camshaft. The oil gallery supplies oil to each individual main bearing, through drilled passages in the block. Passages are drilled from each main bearing to each camshaft bearing. Number 1 main bearing feeds No. 1 camshaft bearing, and No. 2 main bearing feeds No. 2 camshaft bearing, etc. The oil then flows through notches or grooves in the main bearings to lubricate the crankshaft journals. The timing chain and sprockets are lubricated by oil deflected from the front camshaft bearing by an oil drip trough on the cylinder front cover.

The crankshaft is drilled from the main bearings to the connecting rod bearings.

A small groove is located in the connecting rod at the mating face where the cap contacts the connecting rod. This groove is used as an oil squirt hole for cylinder wall lubrication. Oil from the connecting rod squirt hole lubricates the opposite cylinder wall. For example, the No. 1 connecting rod oils No. 5 cylinder, etc. As the crankshaft turns, the hole in the connecting rod bearing aligns with the hole in the journal causing a direct squirt of oil onto the cylinder wall (Fig. 10).

Oil passages are drilled from the main oil gallery to each valve lifter oil gallery. Oil from here feeds the valve lifter assemblies. A reservoir at each valve lifter bore boss traps oil so that oil is available for valve lifter lubrication as soon as the engine starts.

When the hydraulic lifter is on the base circle of the camshaft lobe (valve closed), the oil hole in the hydraulic lifter and plunger is indexed with the lifter oil gallery and oil flows into the plunger. The pressure differential above and below the check valve (disc or ball check) forces the check valve open and oil fills the compression chamber below the plunger. Oil is also metered through the metering valve (disc) through the oil pasasges in the push rod cup and then flows up the hollow push rod. In this position, the drilled hole in the ball end of the push rod in indexed with a drilled hole in the rocker arm and the oil lubricates the upper valve train bearing areas (Fig. 10). Excess oil is returned to the oil pan through drain back holes located at each end of the cylinder head and block (Fig. 10).

AIR INTAKE SYSTEM

The temperature of the air entering the air cleaner is thermostatically controlled by an air intake duct and thermostat assembly (Fig. 4). This

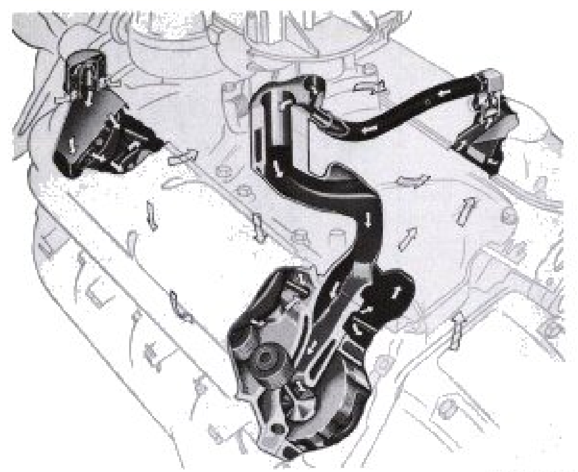

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FIG. 11—Positive Crankcase Ventilation System

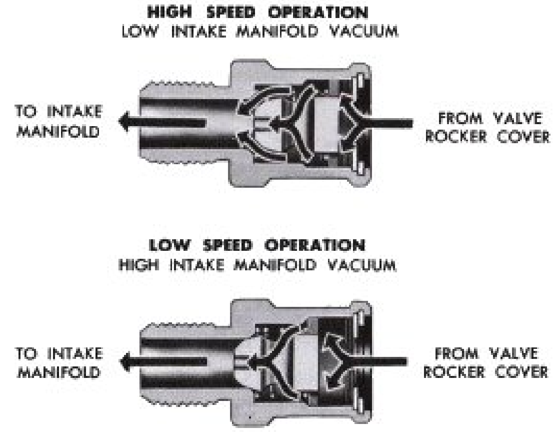

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FIG. 12—Regulator Valve Operation

system supplies warm air to the engine during the warm-up period, resulting in better fuel vaporization and reducing the possibility of carburetor icing. The air duct shroud and tube assembly together with the air duct and thermostat assembly direct warm air into the air cleaner and carburetor.

If the temperature of the air passing over the thermostat is less than 75°F., the valve plate in the air duct is held in an up or "heat on" position by a valve plate tension spring. When the valve plate is in the "heat on" position, the air entering the air cleaner is drawn through the shroud and tube assembly. The air passing through the shroud and tube is first directed over the exhaust manifold and heated.

A wax filled thermostat is connected to the valve plate by a thermostat rod. The incoming air passes over the thermostat before entering the air cleaner. As the temperature of the air passing over the thermostat approaches 85°F., the wax begins to expand and pushes the thermostat rod against the valve plate. The tension of the valve plate spring is overcome and the valve plate is moved downward to partially close off the warm air duct to allow the cooler air from the engine compartment to mix with the warm air directed from the exhaust manifold.

If the temperature of the incoming air is approximately 105°F., the valve plate moves downward to a "heat off" position to close off the warm air duct. Cooler air from the engine compartment is then directed to the air cleaner without passing over the exhaust manifold.

POSITIVE CRANKCASE VENTILATION SYSTEM

The air flow in the positive crankcase ventilation system is shown in Fig. 11.

Ventilating air enters the engine through the oil filler cap located on the front of the left valve rocker arm cover. The filler cap contains a filtering element which filters the incoming air.

From the oil filter cap, the air flows into the front section of the valve rocker arm shaft chamber. The ventilating air moves down past the push rods into the front of the lower crankcase and into the timing chain chamber.

The rotating action of the crankshaft causes the air to flow towards the rear of the crankcase and up into the rear section of the right valve rocker arm cover. The air then enters

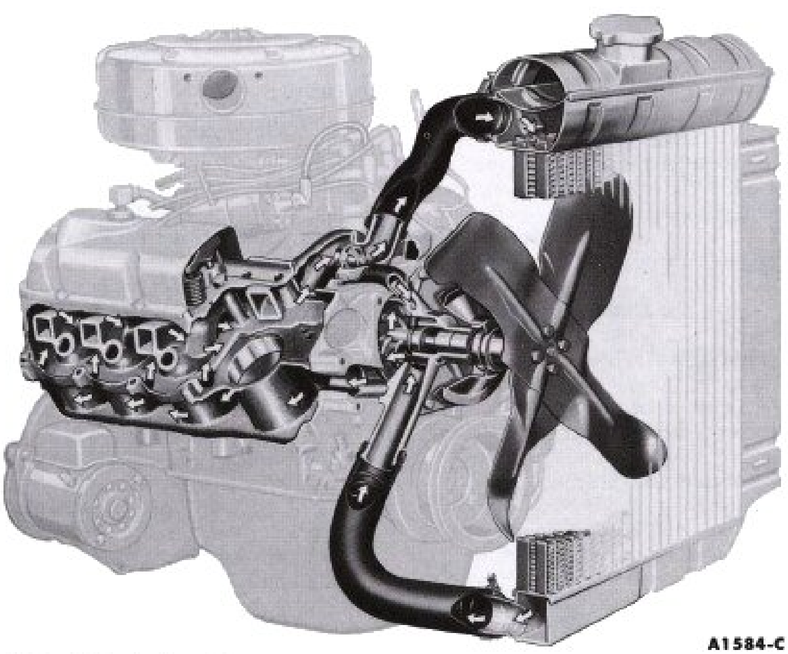

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FIG. 13—Cooling System

a spring-loaded regulator valve that regulates the amount of air to meet changing operating conditions. The air is then directed to the intake manifold through the crankcase vent hose.

During idle, intake manifold vacuum is high. The high vacuum overcomes the tension of the spring pressure and seats the valve (Fig. 12). With the valve in this position, all the ventilating air passes through a calibrated orifice in the valve. With the valve seated, there is minimum ventilation. As engine speed increases and manifold vacuum decreases, the spring forces the valve off its seat and to the full open position (Fig. 12). This increases the flow of ventilating air.

COOLING SYSTEM

The coolant is drawn from the bottom of the radiator by the water pump which delivers the coolant to the cylinder block (Fig. 13).

The coolant travels through cored passages to cool the entire length of each cylinder wall. Upon reaching the rear of the cylinder block, the coolant is directed upward into the cylinder heads, where it cools the combustion chambers, valves and valve seats on its return to the front of the engine.

The coolant from each cylinder head flows through the water passages in the intake manifold past the water thermostat, if it is open, into the top of the radiator. If the thermostat is closed, a small portion of the coolant is returned to the water pump for recirculation. The entire system is pressurized to 13-15 psi.

2 IN-CAR ADJUSTMENTS AND REPAIRS

ENGINE FRONT SUPPORTS

The front supports are located on each side of the cylinder block (Fig. 14). The procedures given apply to either a right or left installation.

To ensure installing the right and left insulator brackets in their proper locations, the right insulator bracket is identified by a yellow stripe painted on the bracket.

REMOVAL

1. Remove the insulator bracket to support bracket lock nuts and washers from both insulator brackets.

2. Raise the engine with a jack and wood block placed under the oil pan.

3. Remove the insulator to engine bolts and lock washers. Remove the insulator assembly and dust shield. Remove the insulator to insulator bracket nuts and washers to separate the insulator from the insulator bracket.

INSTALLATION

1. Position the insulator bracket to the insulator and install the nut and washer. Torque the nut to 26-35 ft-lbs.

2. Position the insulator assembly and dust shield on the engine and install the bolts and lock washers. Torque the bolts to 18-24 ft-lbs.

3. Lower the engine carefully to make sure the insulator bracket studs engage the holes in each support bracket.

4. Install the insulator bracket to support bracket lock nuts and washers on both engine front mounts. Torque the nuts to 20-28 ft-lbs.

ENGINE REAR SUPPORT

REMOVAL

1. Disconnect the parking brake equalizer lever from the support bracket.

2. Support the transmission with a floor jack. Remove the leaf-spring center bolt and lower insulator (Fig. 15). Remove the leaf-spring to transmission extension housing attaching

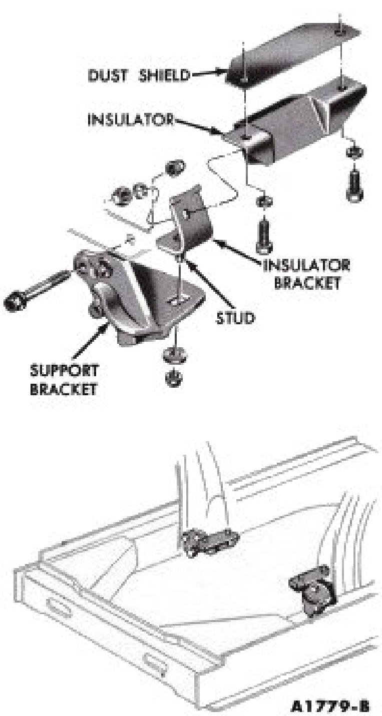


FIG. 14—Engine Front Supports

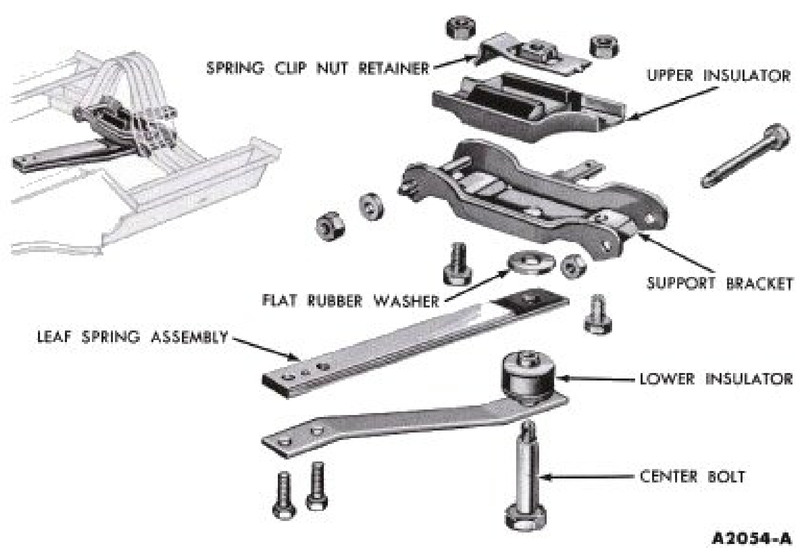


FIG. 15—Engine Rear Support

bolts. Remove the leaf-spring and flat rubber washer.

3. Remove the support bracket to body cross member bolts, and remove the support bracket and upper insulator assembly and spring clip nut retainer.

4. Remove two bolts to disassemble the support bracket and upper insulator.

INSTALLATION

1. Assemble the support bracket and upper insulator (Fig. 15) and tighten the bolts and nuts to specifications.

2. Position the spring clip nut retainer on the upper insulator and support bracket assembly, and install the support bracket assembly on the body cross member. **Make sure there is a minimum clearance of 0.20 inch between the transmission extension housing and the upper insulator.** Tighten the support bracket to body cross member bolts to specifications.

3. Position the flat rubber washer on top of the leaf-spring and install the leaf-spring on the transmission extension housing. Torque the bolts to specifications.

4. Install the lower insulator and center bolt, and tighten the center bolt to specifications. Remove the transmission jack.

5. Connect the parking brake equalizer lever to the support bracket.

INTAKE MANIFOLD

The intake manifold assembly is shown in Fig. 16.

REMOVAL

1. Drain the cooling system. Disconnect the automatic choke heat chamber air inlet hose at the inlet tube near the right valve rocker arm cover. **Do not remove the air inlet hose at the air cleaner.** Remove the air cleaner and intake duct assembly.

2. Disconnect the accelerator rod at the carburetor. Remove the accelerator retracting spring. Remove the bellcrank assembly from the intake manifold and position it out of the way. (On a car with power steering and air conditioning, remove the speed-up control assembly from the bellcrank before removing the bellcrank from the intake manifold).

On a car with an automatic transmission, disconnect the throttle valve vacuum line at the intake manifold.

3. Disconnect the high tension lead and wires at the coil. Remove the coil from the intake manifold. Disconnect the battery ground cable.

4. Disconnect the spark plug wires at the spark plugs by grasping the moulded cap only. Remove the wires from the harness brackets on the valve rocker arm covers. Remove the distributor cap and spark plug wire assembly.

5. Remove the carburetor fuel inlet line and the automatic choke heat tube.

6. Disconnect the distributor vacuum line at the carburetor. Remove the distributor hold down bolt and remove the distributor and vacuum line.

7. Disconnect the radiator upper hose at the coolant outlet housing, and the water temperature sending unit wire at the sending unit. Remove the heater hose from the automatic choke housing and disconnect the hose at the intake manifold.

8. Loosen the clamp on the water pump bypass hose at the coolant outlet housing and slide the hose off the outlet housing.

9. Disconnect the engine ground strap at the block and crankcase vent hose at the carburetor spacer.

10. Remove the intake manifold and carburetor as an assembly. Remove the intake manifold gaskets and seals. Discard the intake manifold retaining bolt sealing washers.

11. If the manifold is to be disassembled, remove the coolant outlet housing, gasket and thermostat. Remove the temperature sending unit, carburetor, spacer and gaskets.

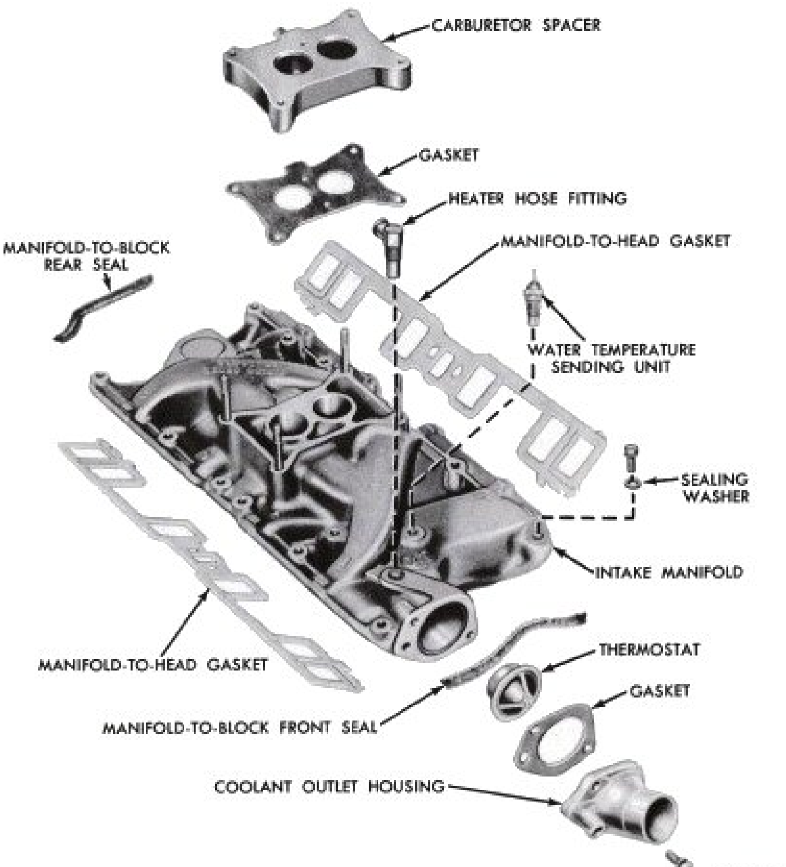


FIG. 16—Intake Manifold Assembly—Typical

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

Intake manifold alignment tools are required when installing the intake manifold on the cylinder block and cylinder heads. Fabricate two

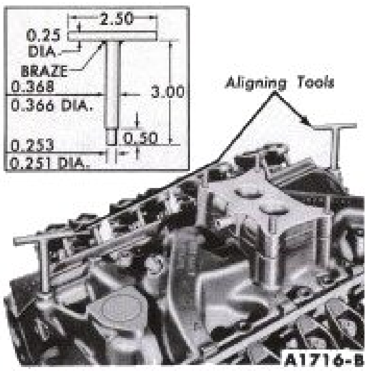


FIG. 17—Intake Manifold Alignment—Typical

alignment tools according to the specifications shown in Fig. 17.

1. If the intake manifold was disassembled, install the temperature sending unit (threads coated with electrical conductive sealer), carburetor, spacer and gaskets. Position the thermostat in the intake manifold. Coat the thermostat gasket with water-resistant sealer and position it on the intake manifold. Install the coolant outlet housing.

2. Clean the mating surfaces of the intake manifold, cylinder heads and cylinder block. Coat the cylinder block seal surfaces with oil-resistant sealer.

3. Position new seals on the cylder block and new gaskets on the cylinder heads with the gaskets interlocked with the seal tabs. Be sure the holes in the gaskets are aligned with the holes in the cylinder heads. The correct installation of the gaskets and seals is shown in Fig. 18.

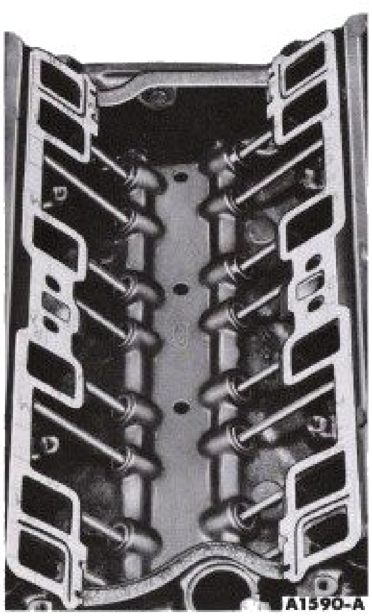


FIG. 18—Intake Manifold Gaskets and Seals Installed

4. Carefully lower the intake manifold into position on the cylinder block and cylinder heads. **After the intake manifold is in place, run a finger around the seal area to make sure the seals are in place. If the seals are not in place, remove the intake manifold and position the seals.**

5. Be sure the holes in the manifold gaskets and manifold are in alignment. Position the intake manifold alignment tools (Fig. 17) in the front and rear bolt holes (Nos. 10 and 12) on the left bank of the manifold.

6. Using new sealing washers, install the intake manifold retaining bolts. Working from the center to the ends, torque the bolts in sequence (Fig. 19) to 3-5 ft-lbs.

7. Remove the manifold alignment tools from the front and rear bolt holes (Nos. 10 and 12). Using new sealing washers, install the two remaining bolts and torque to 3-5 ft-lbs.

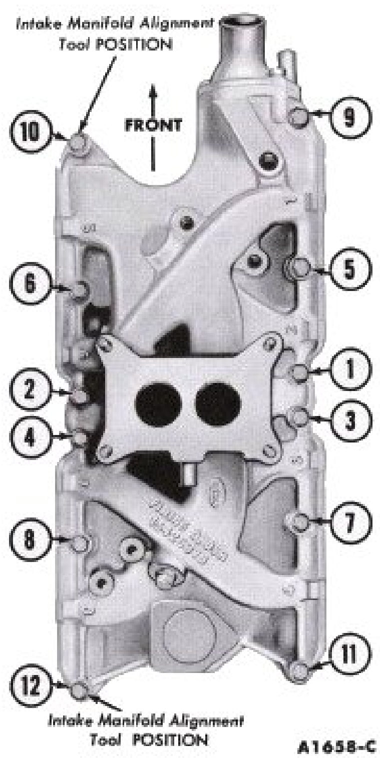


FIG. 19—Intake Manifold Torque Sequence—Typical

8. Torque all the manifold retaining bolts in sequence to 11-14 ft-lbs. Finally, torque all the retaining bolts in sequence to 14-16 ft-lbs.

9. Install the water pump bypass hose on the coolant outlet housing. Slide the clamp into position and tighten the clamp.

10. Connect the water temperature sending unit and the radiator upper hose. Install the heater hose against the automatic choke housing and connect the hose at the intake manifold.

11. Install the carburetor fuel inlet line and the automatic choke heat tube.

12. Rotate the crankshaft damper until the No. 1 piston is on TDC at the end of the compression stroke. Position the distributor in the block with the rotor at the No. 1 firing position and the points open. Install the hold down clamp.

13. Install the distributor cap. Position the spark plug wires in the harness brackets on the valve rocker arm covers, and connect the spark plug wires.

14. Connect the battery ground cable and crankcase vent hose. Install the ignition coil. Connect the high tension lead and coil wires.

15. Install the bellcrank assembly and accelerator retracting spring. Connect the accelerator rod.

On a car with power steering and air conditioning, install the speed-up control assembly on the bellcrank assembly.

On a car with an automatic transmission, connect the throttle valve vacuum line.

16. Fill and bleed the cooling system.

17. Start the engine and check and adjust the ignition timing. Connect the distributor vacuum line at the carburetor.

18. Operate the engine at fast idle and check all hose connections and gaskets for leaks. Operate the engine until engine temperatures have stabilized and adjust the engine idle speed and idle fuel mixture.

On a car with power steering and air conditioning, adjust the speed-up control assembly as outlined in Group 3.

19. Adjust the tranmsission throttle linkage. Install the air cleaner and intake duct assembly.

20. Connect the automatic choke heat chamber air inlet hose.

EXHAUST MANIFOLDS

REMOVAL

1. Disconnect the automatic choke heat chamber air inlet hose at the inlet tube near the right valve rocker arm cover. **Do not remove the air inlet hose at the air cleaner.**

2. Remove the air cleaner and intake duct assembly.

3. Disconnect the exhaust manifold at the muffler inlet pipe.

4. Remove the automatic choke heat tube from the right exhaust manifold.

5. Remove the retaining bolts and tab washers and remove the exhaust manifold.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Clean the mating surfaces of the exhaust manifold and cylinder head. Scrape the gasket material from the mounting flange of the exhaust manifold and muffler inlet pipe.

2. Apply graphite grease to the mating surface of the exhaust manifold.

3. Position the exhaust manifold on the cylinder head and install the retaining bolts and tab washers. Working from the center to the ends, torque the bolts to specifications. Lock the bolts by bending one tab of the washer over a flat on the bolt.

4. Place new gaskets on the muffler inlet pipe. Position the muffler inlet pipe to the manifold. Install and torque the retaining nuts to specifications.

5. Install the automatic choke heat tube on the right exhaust manifold. Install the air cleaner and intake duct assembly.

6. Connect the automatic choke heat chamber air inlet hose.

7. Start the engine and check for exhaust leaks.

POSITIVE CRANKCASE VENTILATION SYSTEM

The positive crankcase ventilation system components are shown in Fig. 20.

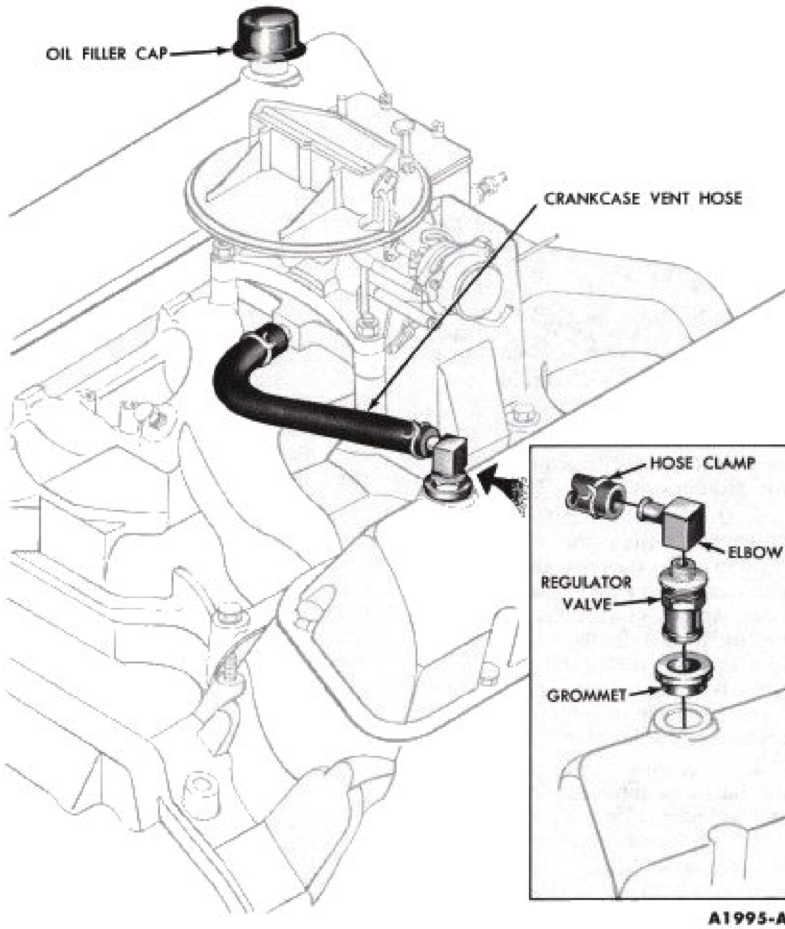


FIG. 20—Positive Crankcase Ventilation System Components

REMOVAL

1. Disconnect the automatic choke heat chamber air inlet hose at the inlet tube near the right valve rocker arm cover. **Do not remove the air inlet hose at the air cleaner.** Remove the air cleaner and intake duct assembly.

2. Using hose clamp pliers, slide both crankcase vent hose clamps towards the center of the vent hose. Disconnect the crankcase vent hose at the carburetor spacer and regulator valve.

3. Pull the regulator valve and fitting (elbow) out of the valve rocker arm cover mounting grommet.

INSTALLATION

1. Insert the regulator valve and fitting (elbow) into the valve rocker arm cover mounting grommet.

2. Position the hose clamps on the vent hose. Connect the vent hose to the carburetor spacer and regulator valve. Using hose clamp pliers, slide the clamps into position.

3. Install the air cleaner and intake duct assembly. Connect the automatic choke heat chamber air inlet hose. Operate the engine and check for leaks.

REGULATOR VALVE DISASSEMBLY

1. Remove the hose fitting (elbow) from the regulator valve.

2. Using a snap ring retainer tool, remove the snap ring retainer from the end of the regulator valve assembly.

3. Remove the valve retaining washer, valve and valve spring (Fig. 21). **Carefully remove the valve spring from the regulator valve to avoid damaging the calibrated spring. Under no circumstances should the calibrated spring be altered in any manner.**

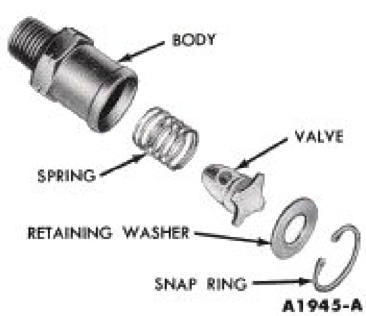


FIG. 21—Regulator Valve Assembly

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

TESTING

Refer to Part 8-1, Section 1 for the test procedures.

REGULATOR VALVE ASSEMBLY

1. Install the spring and valve into the valve body. **Be sure the pointed end of the valve is toward the threaded end or hose connection of the valve.**

2. Install the valve retaining washer and snap ring retainer.

3. Install the hose fitting (elbow) on the regulator valve.

VALVE ROCKER ARM ASSEMBLY

The valve rocker arm assembly is shown in Fig. 22.

REMOVAL

1. Disconnect the automatic choke heat chamber air inlet hose at the inlet tube near the right valve rocker arm cover. **Do not remove the air inlet hose at the air cleaner.**

2. Remove the air cleaner and intake duct assembly.

3. Disconnect the spark plug wires at the spark plugs by grasping the moulded cap only. Remove the wires from the bracket on the valve rocker arm cover(s) and position the wires out of the way.

To remove the right valve rocker arm cover, remove the automatic choke heat tube. Remove the crankcase ventilation regulator valve from the valve rocker arm cover.

4. Remove the valve rocker arm cover(s).

5. Remove the valve rocker arm stud nut, fulcrum seat and rocker arm.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

If removal of the rocker arm stud is necessary, refer to the procedure under "Cylinder Head Repairs" in Part 8-1, Section 2.

INSTALLATION

1. Apply Lubriplate to the top of the valve stem and at the push rod guide in the cylinder head.

2. Install the valve rocker arm, fulcrum seat and stud nut. Adjust the valve clearance following the procedure in Part 8-1, Section 2.

3. Clean the valve rocker arm cover(s) and the cylinder head gasket surface. Apply oil-resistant sealer to one side of new cover gasket(s). Lay the cemented side of the gasket(s) in place in the cover(s) as shown in Fig. 23.

4. Position the cover(s) on the cylinder head(s). Make sure the gasket seats evenly all around the head. Install the bolts. The cover is tightened in two steps. Torque the bolts to specifications. Two minutes later, torque the bolts to the same specifications.

If the right cover was removed, install the automatic choke heat tube and the crankcase ventilation regulator valve.

5. Install the spark plug wires in the bracket on the valve rocker arm cover(s). Connect the spark plug wires.

6. Install the air cleaner and intake duct assembly.

7. Connect the automatic choke heat chamber air inlet hose.

CYLINDER HEADS

REMOVAL

1. Remove the intake manifold and carburetor as an assembly following the procedure under "Intake Manifold Removal."

2. Disconnect the battery ground cable at the cylinder head. Remove the rocker arm cover(s).

On a car with an air conditioner, isolate and remove the compressor as outlined in Group 15.

On a car with power steering, disconnect the power steering pump bracket from the left cylinder head and remove the drive belt from the pump pulley. Wire the power steering pump out of the way and in a position that will prevent the oil from draining out.

3. Disconnect the wires at the generator or alternator. Remove the generator or alternator mounting bracket bolts and remove the generator or alternator, shield and bracket as an assembly.

4. Disconnect the exhaust manifold(s) at the muffler inlet pipe(s).

5. Loosen the rocker arm stud nuts so that the rocker arms can be rotated to the side. Remove the push rods in sequence (Fig. 24).

6. Install the cylinder head holding fixtures (Fig. 25). Remove the cylinder head retaining bolts and lift the cylinder head off the block. **Do not pry between the head and the block.** Remove and discard the cylinder head gasket.

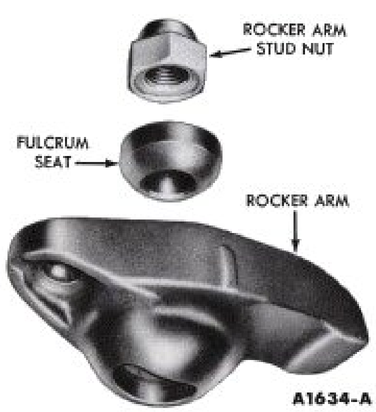


FIG. 22—Valve Rocker Arm Assembly

FIG. 23—Valve Rocker Arm Cover Gasket Installation

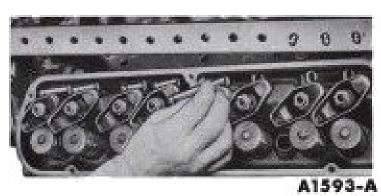


FIG. 24—Valve Push Rod Removal

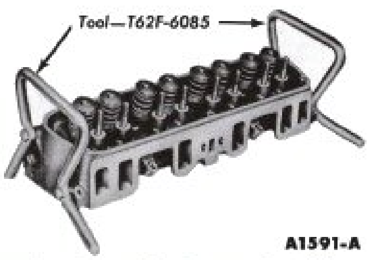


FIG. 25—Cylinder Head Holding Fixtures

INSTALLATION

1. Clean the cylinder head and cylinder block gasket surfaces. If the cylinder head was removed for a cylinder head gasket replacement, check the flatness of the cylinder head and block gasket surfaces.

2. Position the new cylinder head gasket over the cylinder dowels on the block. Coat the head bolts with water-resistant sealer. Position the cylinder head to the block and install the retaining bolts. Remove the holding fixtures.

3. The cylinder head bolts are tightened in three progressive steps. Torque all the bolts in sequence (Fig. 26) to 50 ft-lbs., then to 60 ft-lbs, and finally to specifications. **After the cylinder head bolts have been torqued to specifications, the bolts should not be disturbed.**

4. Clean the push rods in a suitable solvent. Blow out the oil passage in the push rod with compressed air. Check the ends of the push rods for nicks, grooves, roughness or excessive wear. Visually check the push rods for straightness or check push rod runout with a dial indicator. If runout exceeds the maximum limit at any point, discard the rod **Do not attempt to straighten push rods.**

5. Install the push rods in their original positions. Apply Lubriplate to the valve stem tips and the push rod guides in the cylinder head.

6. Install the rocker arms. Perform a valve clearance adjustment as outlined in Part 8-1, Section 2.

FIG. 26—Cylinder Head Bolt Torque Sequence

7. Position a new gasket(s) on the muffler inlet pipe(s). Connect the exhaust manifold(s) at the muffler inlet pipe(s). Torque the nuts to specifications.

8. Position the generator or alternator, shield and bracket and position the drive belt over the pulley. Install the retaining bolts and adjust the drive belt tension to specifications. Connect the generator or alternator wires.

9. Connect the battery ground cable. Apply oil-resistant sealer to one side of new cover gaskets. Lay the cemented side of the gaskets in place in the cover(s). Install the valve rocker arms cover(s).

On a car with an air conditioner, install the compressor as outlined in Group 15.

On a car with power steering, install the drive belt and power steering pump bracket. Install the bracket retaining bolts. Adjust the drive belt to specifications.

10. Install the intake manifold and related parts following the procedure under "Intake Manifold Installation."

DISASSEMBLY

1. Clean the carbon out of the cylinder head combustion chambers before removing the valves.

2. Compress the valve springs (Fig. 27). Remove the spring retainer locks and release the spring.

3. Remove the spring retainer, spring, stem seal and valve. Discard valve stem seals. Identify all valve parts.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

FIG. 27—Compressing Valve Spring—On Bench

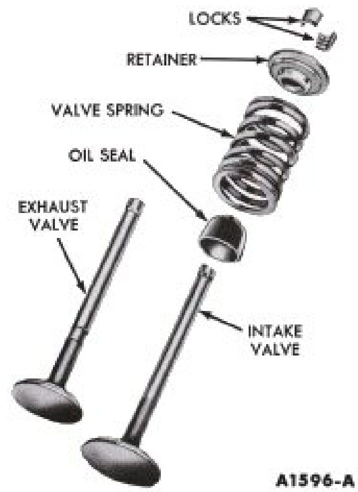


FIG. 28—Valve Assembly

REPAIRS

Cylinder head repair and rocker arm stud replacement procedures, and checks such as valve and valve seat refacing, cylinder head flatness checks, etc., are covered in Part 8-1, Section 2.

ASSEMBLY

1. Install each valve (Fig. 28) in the port from which it was removed or to which it was fitted. Install a new stem seal on the valve.

2. Install the valve spring over the valve, and then install the spring retainer. Compress the spring and install the retainer locks (Fig. 27).

3. Measure the assembled height of the valve spring from the surface of the cylinder head spring pad to the underside of the spring retainer with dividers (Fig. 29). Check the dividers against a scale. If the assembled

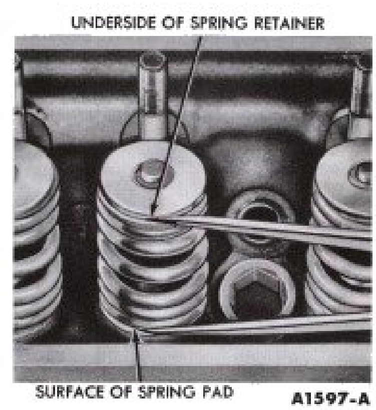


FIG. 29—Valve Spring Assembled Height

height is greater than specifications, install the necessary 0.030-inch thick spacer(s) between the cylinder head spring pad and the valve spring to bring the assembled height to the recommended height.

Do not install the spacers unless necessary. Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which could lead to spring breakage and worn camshaft lobes.

VALVE SPRING, RETAINER AND STEM SEAL REPLACEMENT

Broken valve springs, or defective valve stem seals and retainers may be replaced without the need of removing the cylinder head, providing damage to the valve or valve seat has not occurred.

1. Disconnect the automatic choke heat chamber air inlet hose at the inlet tube near the right valve rocker arm cover. **Do not remove the air inlet hose at the air cleaner.**

2. Remove the air cleaner and intake duct assembly.

To remove the right valve rocker arm cover, remove the automatic choke heat tube. Remove the crankcase ventilation regulator valve from the valve rocker arm cover.

3. Remove the valve rocker arm cover and the applicable spark plug.

4. Crank the engine until the applicable piston is on TDC after the compression stroke. Be sure that both valves are closed. **Be sure that the piston is on TDC to prevent the crankshaft from turning when the air is applied.**

5. Install an air line with an adapter in the spark plug hole and turn on the air supply.

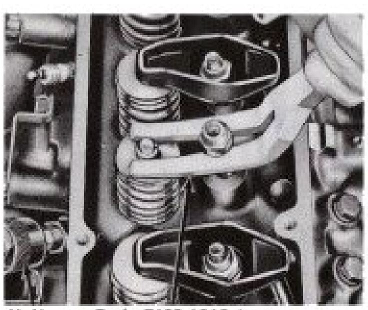


FIG. 30—Compressing Valve Spring—In Chassis

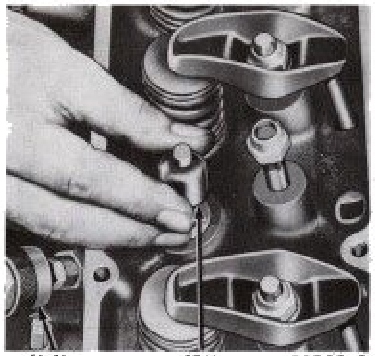


FIG. 31—Valve Stem Seal Removal or Installation

6. Remove the applicable valve rocker arm stud nut, fulcrum seat, valve rocker arm and push rod. Install the stud nut and position the compressor tool as shown in Fig. 30. Compress the valve spring and remove the retainer locks, spring retainer and valve spring.

7. Remove and discard the valve stem seal (Fig. 31).

8. Install a new valve stem seal (Fig. 31). Place the spring in position over the valve and install the valve spring retainer. Compress the valve spring and install the valve spring retainer locks. Remove the compressor tool and stud nut.

9. Install the push rod. Apply Lubriplate to the tip of the valve stem and at the push rod guide in the cylinder head.

10. Install the valve rocker arm, fulcrum seat and stud nut. Adjust the valve clearance following the procedure in Part 8-1, Section 2.

11. Turn off the air and remove the air line and adapter. Install the spark plug and connect the spark plug wire.

12. Clean and install the rocker arm cover.

If the right cover was removed install the automatic choke heat tube and the crankcase ventilation regulator valve.

13. Install the air cleaner and intake duct assembly.

14. Connect the automatic choke heat chamber air inlet hose.

CYLINDER FRONT COVER AND TIMING CHAIN

REMOVAL

1. Drain the cooling system and the crankcase. Disconnect the battery ground cable.

2. Disconnect the automatic choke heat chamber air inlet hose at the inlet tube near the right valve rocker arm cover. **Do not remove the air inlet hose at the air cleaner.** Remove the air cleaner and intake duct assembly.

3. Disconnect the radiator upper hose at the coolant outlet housing, and the radiator lower hose at the water pump.

4. Disconnect the heater hose at the water pump. Slide the water pump bypass hose clamp toward the water pump.

5. Loosen the generator or alternator mounting bolts at the generator or alternator. Remove the generator or alternator suport bolt at the water pump.

6. Remove the fan, spacer, pulley and drive belt.

On a car with power steering, loosen the drive belt tension and remove the belt.

On a car with an air conditioner, remove the compressor drive belt.

7. Remove the crankshaft pulley from the crankshaft vibration damper. Remove the cap screw and washer from the end of the crankshaft. Install the puller on the crankshaft vibration damper (Fig. 32) and remove the vibration damper.

8. Disconnect the fuel pump outlet line at the fuel pump. Remove the fuel pump retaining bolts and lay the pump to one side with the flexible fuel line still attached.

9. Remove the oil level dipstick. Disconnect the dipstick tube bracket at the generator or alternator mounting bracket.

10. Remove the oil pan to cylinder front cover retaining bolts. Remove the cylinder front cover and water pump as an assembly (one screw retains the fuel line bracket).

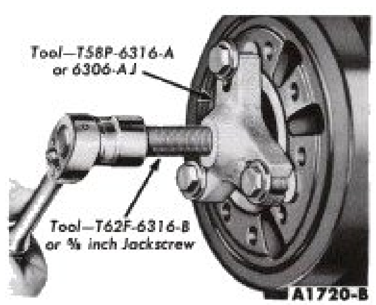
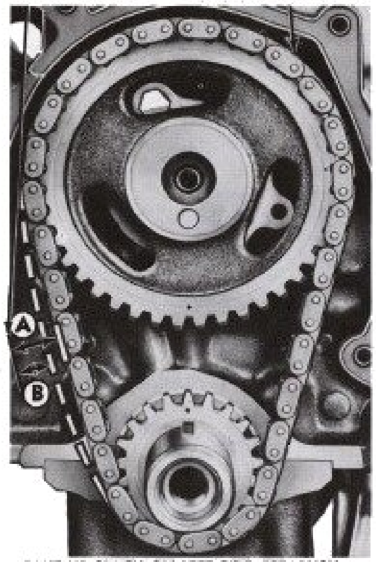


FIG. 32—Crankshaft Vibration Damper Removal



TAKE UP SLACK ON LEFT SIDE, ESTABLISH A REFERENCE POINT. MEASURE DISTANCE **A**. TAKE UP SLACK ON RIGHT SIDE. FORCE LEFT SIDE OUT. MEASURE DISTANCE **B**. DEFLECTION IS **A** MINUS **B**. A1602-B

FIG. 33—Timing Chain Deflection

If a new cylinder front cover is to be installed, remove the water pump and dipstick tube from the old cylinder front cover and install them on the new cover.

11. Discard the cylinder front cover gasket. Remove the crankshaft front oil slinger.

12. Rotate the crankshaft in a clockwise direction (as viewed from the front) to take up the slack on the left side of the chain.

13. Establish a reference point on the block and measure from this point to the chain (Fig. 33).

14. Rotate the crankshaft in the opposite direction to take up the slack on the right side of the chain. Force the left side of the chain out with the fiingers and measure the distance between the reference point and the chain. The deflection is the difference between the two measurements.

If the deflection exceeds ½ inch, replace the timing chain and/or sprockets.

15. Crank the engine until the timing marks on the sprockets are positioned as shown in Fig. 34.

16. Remove the camshaft sprocket cap screw, washers and fuel pump eccentric. Slide both sprockets and the timing chain forward, and remove them as an assembly (Fig. 35).

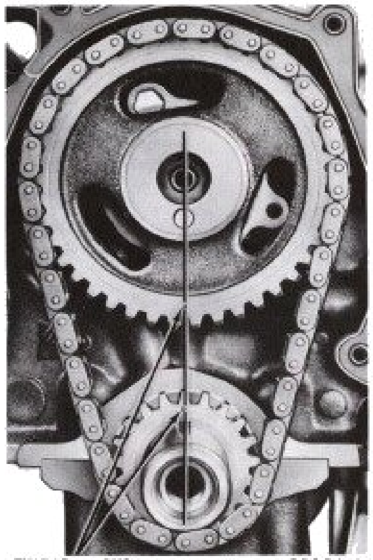


FIG. 34—Aligning Timing Marks

17. Remove the oil pan and oil pump following the procedure under "Oil Pan Removal" and "Oil Pump Removal".

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

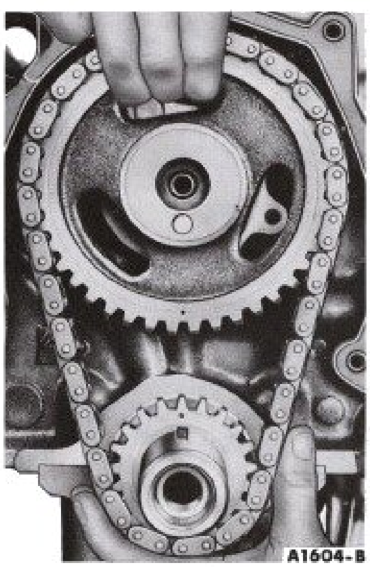


FIG. 35—Timing Chain Removal or Installation

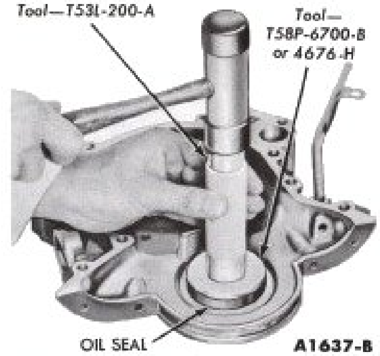


FIG. 36—Crankshaft Front Oil Seal Replacement

FRONT OIL SEAL REPLACEMENT

It is good practice to replace the oil seal each time the cylinder front cover is removed.

1. Drive out the old seal with a pin punch. Clean out the recess in the cover.

2. Coat a new seal with grease, then install the seal (Fig. 36). Drive the seal in until it is fully seated in the recess. Check the seal after installation to be sure the spring is properly positioned in the seal.

INSTALLATION

1. Position the sprockets and timing chain on the camshaft (Fig. 35). Be sure the timing marks on the sprockets are positioned as shown in Fig. 34.

2. Install the fuel pump eccentric, washers and camshaft sprocket cap screw. Torque the sprocket cap screw to specifications. Install the crankshaft front oil slinger (Fig. 37).

3. Clean the cylinder front cover, oil pan and the block gasket surfaces.

4. Coat the gasket surfaces of the block and cover with sealer. Position a new gasket on the block.

5. Install the alignment pilot tool on the cylinder front cover so that the keyway in the pilot aligns with the key in the crankshaft. Position the cover and pilot over the end of the crankshaft and against the block (Fig. 38). Coat the threads of the retaining screws with water-resistant sealer and install the screws (one screw retains the fuel line bracket). While pushing in on the pilot, torque the screws to specifications. Remove the pilot.

6. Line up the crankshaft vibration damper keyway with the key on

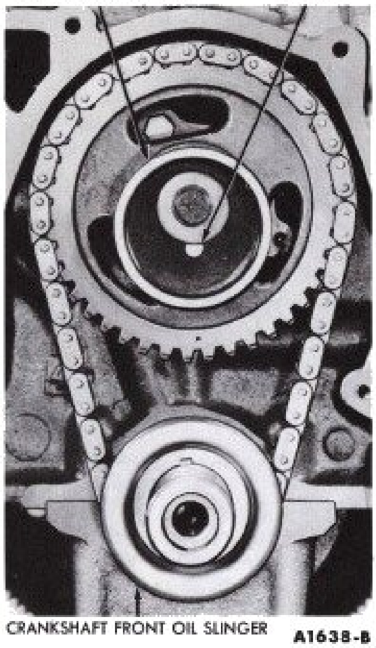


FIG. 37—Fuel Pump Eccentric and Front Oil Slinger Installed

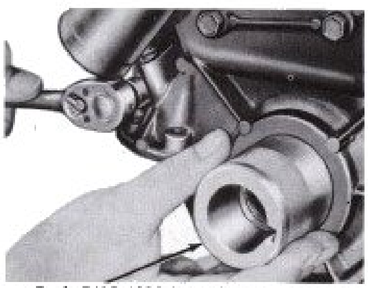


FIG. 38—Cylinder Front Cover Alignment

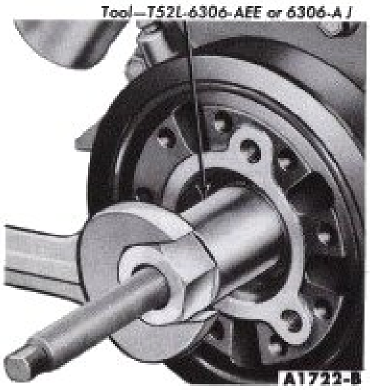


FIG. 39—Crankshaft Vibration Damper Installation

the crankshaft. Install the vibration damper on the crankshaft (Fig. 39). Install the cap screw and washer. Torque the screw to specifications. Install the crankshaft pulley.

7. Install the oil pump and oil pan following the procedure under "Oil Pump Installation" and "Oil Pan Installation."

8. Install the fuel pump using a new gasket. Connect the fuel pump outlet pipe.

9. Connect the dipstick tube bracket at the generator mounting bracket. Install the oil level dipstick.

On a car with power steering, install the drive belt and tighten the power steering pump bracket. Adjust the drive belt tension to specifications.

On a car with an air conditioner, install and adjust the drive belt to specifications.

10. Install the water pump pulley, drive belt, spacer and fan.

11. Install the generator or alternator support bolt at the water pump. Tighten the generator or alternator mounting bolts. Adjust the drive belt tension to specifications.

12. Connect the heater hose and the water pump bypass hose. Slide the bypass hose clamp into position.

13. Connect the radiator upper and lower hoses. Connect the battery ground cable.

14. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of engine oil.

15. Operate the engine at fast idle and check for coolant and oil leaks. Check and adjust the ignition timing.

16. Install the air cleaner and intake duct assembly.

17. Connect the automatic choke heat chamber air inlet hose.

CAMSHAFT

The camshaft and related parts are shown in Fig. 40.

REMOVAL

1. Remove the cylinder front cover and the timing chain following the procedure under "Cylinder Front Cover and Timing Chain Removal."

2. Disconnect the spark plug wires at the spark plugs and remove the wires from the ignition harness brackets on the valve rocker arm covers. Disconnect the coil high tension lead at the coil. Remove the distributor cap and spark plug wire assembly.

3. Disconnect the ignition coil wires at the coil and remove the coil from the intake manifold.

4. Disconnect the distributor vacuum line at the carburetor. Remove the distributor hold down bolt and clamp and remove the distributor.

5. Disconnect the carburetor fuel inlet line at the carburetor and fuel pump. Remove the fuel line. Disconnect the automatic choke heat tube at the carburetor. Remove the heater hose from the automatic choke and disconnect the hose at the intake manifold.

On a car with an automatic transmission, disconnect the throttle valve vacuum line at the intake manifold. Disconnect the transmission oil cooler lines at the radiator.

6. Remove the radiator.

7. Disconnect the accelerator rod at the carburetor. Remove the accelerator retracting spring. Remove the

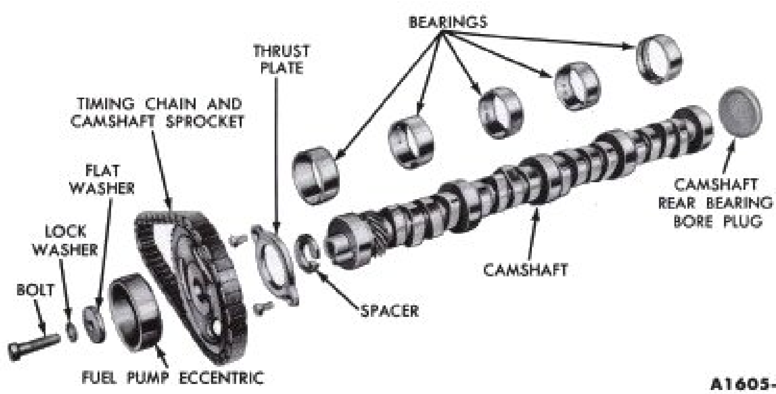


FIG. 40—Camshaft and Related Parts

bellcrank assembly from the intake manifold and position it out of the way. (On a car with power steering and air conditioning, remove the speed-up control assembly from the bellcrank before removing the bellcrank from the intake manifold).

8. Disconnect the water temperature sending unit wire at the sending unit and the engine ground strap at the engine.

9. Disconnect the crankcase vent hose from the carburetor spacer. Remove the intake manifold and carburetor as an assembly. Remove the intake manifold gaskets and seals.

10. Remove the crankcase ventilation regulator valve from the valve rocker arm cover. Remove the valve rocker arm covers. Loosen the valve rocker arm stud nuts and rotate the rocker arms to the side.

11. Remove the valve push rods in sequence so that they can be installed in their original positions.

12. Using a magnet, remove the valve lifters and place them in a rack so that they can be installed in their original bores (Fig. 41).

If the valve lifters are stuck in their bores by excessive varnish, etc. it may be necessary to use a plier-type tool (T52T-6500-DJD or 6500-D) to remove the lifters. Rotate the lifter back and forth to loosen it from the gum or varnish that may have formed at the lifter.

13. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. **Use caution to avoid damaging the camshaft bearings.**

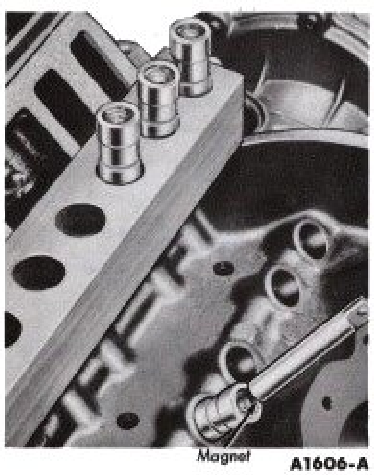


FIG. 41—Valve Lifter Removal

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Refer to Part 8-1, Section 2 for the repair procedures.

INSTALLATION

1. Oil the camshaft and apply Lubriplate to the lobes. Carefully slide the camshaft through the bearings. Install the camshaft thrust plate.

2. Install the valve lifters in the bores from which they were removed.

3. Install the push rods in their original position. Apply Lubriplate to the valve stem tips and the push rod guides in the cylinder head. Position the rocker arms over the push rods.

4. Install the intake manifold and related parts by following steps 1 thru 6 under "Intake Manifold Installation."

5. Connect the water temperature sending unit and the engine ground strap.

6. Install the bellcrank assembly and accelerator retracting spring. Connect the accelerator rod.

On a car with power steering install the speed-up control assembly on the bellcrank assembly.

7. Install the radiator.

On a car with an automatic transmission, connect the transmission oil cooler lines and throttle valve vacuum line.

8. Install the heater hose against the automatic choke housing and connect the heater hose at the intake manifold. Position and connect the fuel line.

9. Replace the crankshaft front oil seal. Install the timing chain, cylinder front cover and related parts following steps 1 thru 13 under "Cylinder Front Cover and Timing Chain Installation."

10. With No. 1 piston on TDC at the end of the compression stroke, position the distributor in the block with the rotor at the No. 1 firing position and the points open. Install the hold down clamp.

11. Perform a valve clearance adjustment as outlined in Part 8-1, Section 2.

12. Clean the valve rocker arm covers and the cylinder head gasket surface. Apply oil-resistance sealer to one side of new cover gaskets. Lay the cemented side of the gaskets in place in the covers.

13. Position the covers on the cylinder heads. Make sure the gasket seats evenly all around the head. Install the bolts. The cover is tightened in two steps. Torque the bolts to specifications. Two minutes later, torque the bolts to the same specifications.

14. Clean the crankcase ventilation regulator valve, fitting and vent hose (Part 8-1, Section 2). Insert the regulator and fitting into the valve rocker arm cover mounting grommet. Position and install the crankcase vent hose.

15. Install the automatic choke heat tube. Install the ignition coil and connect the wires.

16. Install the distributor cap. Position the spark plug wires in the harness brackets on the valve rocker arm covers and connect the spark plug wires. Connect the high tension lead at the coil.

17. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of engine oil.

18. Start the engine and check and adjust the ignition timing. Connect the distributor vacuum line at the carburetor.

19. Operate the engine at fast idle and check all hose connections and gaskets for leaks. Operate the engine until engine temperatures have stabilized and adjust the engine idle speed and idle fuel mixture.

On a car with power steering, adjust the speed-up control assembly as outlined in Group 3.

20. Adjust the transmission throttle linkage. Install the air cleaner and intake duct assembly.

21. Connect the automatic choke heat chamber air inlet hose.

CAMSHAFT REAR BEARING BORE PLUG REPLACEMENT

1. On a car with a manual-shift transmission, remove the transmission, clutch pressure plate and disc following the procedures in Group 5.

On a car with an automatic transmission, remove the transmission and converter housing following the procedure in Group 7.

2. Remove the flywheel retaining bolts and remove the flywheel.

3. Drill a ½-inch hole in the camshaft rear bearing bore plug and remove the plug using the tools shown in Fig. 62.

4. Clean out the plug bore recess thoroughly and coat the flange of a new plug with oil-resistant sealer. Install the new plug with the flange facing out. Drive the plug in until it is slightly below the chamfer in the bore (Fig. 65).

5. Coat the flywheel retaining bolts with oil-resistant sealer. Position the flywheel on the crankshaft flange. Install and torque the retaining bolts in sequence across from each other to specifications.

On a car with a manual-shift transmission, install the clutch pressure plate, disc and the transmission following the procedures in Group 5.

On a car with an automatic transmission, install the transmission and converter housing following the procedure in Group 7.

HYDRAULIC VALVE LIFTER REPLACEMENT

1. Remove the intake manifold and related parts by following steps 1 thru 10 under "Intake Manifold Removal."

2. Remove the crankcase ventilation regulator valve from the valve rocker arm cover. Remove the valve rocker arm covers. Loosen the valve rocker arm stud nuts and rotate the rocker arms to the side.

3. Remove the valve push rods in sequence so that they can be installed in their original positions.

4. Using a magnet, remove the valve lifters and place them in a rack so that they can be installed in their original bores (Fig. 41).

If the valve lifters are stuck in their bores by excessive varnish, etc., it may be necessary to use a plier-type tool (T52T-6500-DJD or 6500-D) to remove the lifters. Rotate the lifter back and forth to loosen it from the gum or varnish that may have formed at the lifter.

The internal parts of each hydraulic valve lifter assembly are matched sets. Do not intermix the parts. Keep the assemblies intact until they are to be cleaned.

5. Clean and install the valve lifters in the bores from which they were removed. If a new lifter(s) is being installed, test the new lifter(s) for a free fit in the bore in which it is to be installed.

6. Install the push rods in their original position. Apply Lubriplate to the valve stem tips and the push rod guides in the cylinder head.

7. Position the rocker arms over the push rods. Perform a valve clearance adjustment as outlined in Part 8-1, Section 2.

8. Install the valve rocker arm covers. Install the crank case ventilation regulator valve in the valve rocker arm cover.

9. Install the intake manifold and related parts by following steps 2 thru 20 under "Intake Manifold Installation."

HYDRAULIC VALVE LIFTER DISASSEMBLY

Each valve lifter is a matched assembly. If the parts of one lifter are intermixed with those of another, improper valve operation may result. Disassemble and assemble each lifter separately. Keep the lifter assemblies in proper sequence so that they can be installed in their original bores.

1. Grasp the lock ring with needle nose pliers to release it from the groove. It may be necessary to depress the plunger to fully release the lock ring.

2. Remove the push rod cup, metering valve (disc), plunger and spring.

3. Invert the plunger assembly and remove the check valve retainer by carefully prying up on it with a screw driver. Remove the check valve (disc or ball check) and spring.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

HYDRAULIC VALVE LIFTER ASSEMBLY

A typical hydraulic valve lifter assembly is shown in Fig. 42.

1. Place the plunger upside down on a clean work bench.

2. Place the check valve (disc or ball check) in position over the oil hole on the bottom of the plunger. Set the check valve spring on top of the check valve (disc or ball check).

3. Position the check valve retainer over the check valve and spring and push the retainer down into place on the plunger.

4. Place the plunger spring, and then the plunger (open end up) into the lifter body.

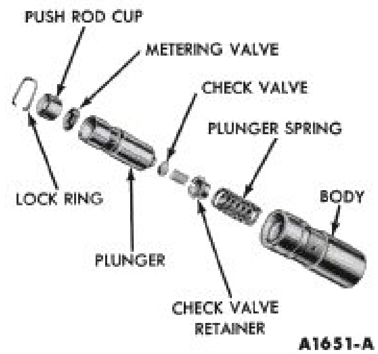


FIG. 42—Typical Hydraulic Valve Lifter Assembly

5. Position the metering valve (disc) in the plunger, then place the push rod seat in the plunger.

6. Depress the plunger, and position the closed end of the lock ring in the groove of the lifter body. With the plunger still depressed, position the open ends of the lock ring in the groove. Release the plunger, then depress it again to fully seat the lock ring.

TESTING

Refer to Part 8-1, Section 1 for the testing procedures.

MAIN AND CONNECTING ROD BEARING REPLACEMENT

The main and connecting rod bearing inserts are selective fit. **Do not file or lap bearing caps or use bearing shims to obtain the proper bearing clearance.**

Selective fit bearings are available for service in standard sizes only. Standard bearings are divided into two sizes and are identified by a daub of red or blue paint. Refer to the Parts Catalog for the available sizes. **Red marked bearings increase the clearance; blue marked bearings decrease the clearance.** Undersize bearings, which are not selective fit, are available for use on journals that have been refinished.

MAIN BEARING

1. Drain the crankcase. Remove the oil level dipstick. Remove the oil pan and related parts.

2. Remove the oil pump inlet tube assembly and the oil pump.

3. **Replace one bearing at a time, leaving the other bearings securely fastened.** Remove the main bearing cap to which new bearings are to be installed.

4. Insert the upper bearing removal tool (tool 6331) in the oil hole in the crankshaft.

5. Rotate the crankshaft in the direction of the engine rotation to force the bearing out of the block.

6. Clean the crankshaft journal. **When replacing standard bearings with new bearings, it is good practice to first try to obtain the proper clearance with two blue bearing halves.**

7. To install the upper main bearing, place the plain end of the bearing over the shaft on the locking tang side of the block and partially install the bearing so that tool 6331 can be inserted in the oil hole in the crankshaft. With tool 6331 positioned in the oil hole in the crankshaft, rotate the crankshaft in the opposite direction of engine rotation until the bearing seats itself. Remove the tool.

8. Replace the cap bearing.

9. Support the crankshaft so that its weight will not compress the Plastigage and provide an erroneous reading. Position a jack so that it will bear against the counterweight adjoining the bearing which is being checked.

10. Place a piece of Plastigage on the bearing surface the full width of the bearing cap and about ¼ inch off center (Fig. 43).

11. Install the cap and torque the bolts to specifications. **Do not turn the crankshaft while the Plastigage is in place.**

12. Remove the cap. Using the Plastigage scale, check the width of the Plastigage. When checking the width of the Plastigage, check at the widest point in order to get the minimum clearance Check at the narrowest point in order to get the maximum clearance.The difference between the two readings is the taper.

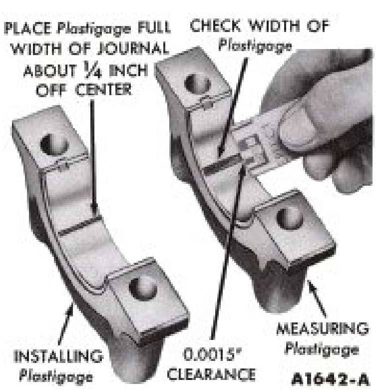


FIG. 43—Installing and Measuring Plastigage—Engine Installed

13. If the clearance is less than the specified limits, try two red bearing halves or a combination of red and blue depending upon the condition. If the standard bearings do not bring the clearance within the desired limits, refinish the crankshaft journal, then install undersize bearings.

14. After the bearing has been fitted, apply a light coat of engine oil to the journal and bearings, then install the bearing cap. Torque the cap bolts to specifications.

15. Repeat the procedure for the remaining bearings that require replacement.

16. If the rear main bearing is to be replaced, remove the rear main bearing cap. Remove and discard the rear oil seal.

17. Clean the rear journal oil seal groove and the mating surfaces of the block and rear main bearing cap. Preform the new seal by hand to the approximate radius of the cap.

18. Insert the seal in the oil seal groove, seating the center of the seal first and allowing the seal to extend equally on both ends. Press the seal down firmly with the thumb at the center of the seal, then press both ends of the seal into the groove, working from the ends to the center.

19. Position the seal forming tool as shown in Fig. 44 and complete the seal installation. After installation, cut the ends of the seal flush.

FIG. 44—Seal to Rear Bearing Cap Installation

20. Apply a thin coating of oil-resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 44). **Do not apply sealer to the area forward of the oil slinger groove.** Install the rear main bearing cap and torque the cap bolts to specifications.

21. If the thrust bearing cap (No. 3 main bearing) has been removed, install it as follows:

Install the thrust bearing cap with the bolts finger-tight. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 60). Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 60). This will align the thrust surfaces of both halves of the bearing. Retain the forward pressure on the crankshaft. Torque the cap bolts to specifications (Fig. 60).

22. Clean the oil pump inlet tube screen. Install the oil pump and the inlet tube assembly.

23. Position the oil pan gaskets on the oil pan. Position the oil pan front seal on the cylinder front cover. Position the oil pan rear seal on the rear main bearing cap. Install the oil pan and related parts. Install the oil level dipstick.

24. Fill the crankcase. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil leaks.

CONNECTING ROD BEARING

1. Follow steps 1 and 2 under "Main Bearing Replacement."

2. Turn the crankshaft until the connecting rod to which new bearings are to be fitted is down. Remove the connecting rod cap. Remove the bearing inserts from the rod and cap.

3. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure.

4. Clean the crankshaft journal. **When replacing standard bearings with new bearings, it is good practice to first try to obtain the proper clearance with two blue bearing halves.**

5. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.

6. Pull the connecting rod assembly down firmly on the crankshaft journal.

7. Place a piece of Plastigage on the lower bearing surface, the full width of the cap and about ¼ inch off-center.

8. Install the cap and torque the connecting rod nuts to specifications. **Do not turn the crankshaft while the Plastigage is in place.**

9. Refer to steps 12 and 13 under "Main Bearing Replacement."

10. After the bearing has been fitted, clean and apply a light coat of engine oil to the journal and bearings. Install the conecting rod cap. Torque the nuts to specifications.

11. Repeat the procedure for the remaining connecting rods that require new bearings.

12. Follow steps 22 thru 24 under "Main Bearing Replacement."

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspecting procedures.

PISTONS AND CONNECTING RODS

REMOVAL

1. Drain the cooling system and the crankcase. Remove the intake manifold, cylinder heads, oil pan and oil pump following the procedures in this section.

2. Remove any ridge and/or deposits from the upper end of the cylinder bores as follows:

Turn the crankshaft until the piston to be removed is at the bottom of its travel and place a cloth on the piston head to collect the cuttings. Remove any ridge and/or deposits from the upper end of the cylinder bores. Remove the cylinder ridge with a ridge cutter. Follow the instructions furnished by the tool manufacturer. **Never cut into the ring travel area in excess of 1/32 inch when removing ridges.**

3. Make sure all connecting rod caps are marked so that they can be installed in their original positions.

4. Turn the crankshaft until the connecting rod being removed is down.

5. Remove the connecting rod cap.

6. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a hammer. **Avoid damage to the crankshaft journal or the cylinder wall when removing the piston and rod.**

7. Remove the bearing inserts from the connecting rod and cap.

8. Install the cap on the connecting rod from which it was removed.

INSTALLATION

1. If new piston rings are to be installed, remove the cylinder wall glaze. Follow the instructions of the tool manufacturer.

2. Oil the piston rings, pistons and cylinder walls with light engine oil. **Be sure to install the pistons in the same cylinders from which they were removed or to which they were fitted. The connecting rod and bearing caps are numbered from 1 to 4 in the right bank and from 5 to 8 in the left bank, beginning at the front of the engine. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever transposed from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder number.**

3. Make sure the ring gaps are properly spaced around the circumference of the piston.

4. Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Fig. 45). Be sure to guide the connecting rods to avoid damaging the crankshaft journals. **Install the piston with the indentation notch in the piston head toward the front of the engine.**

5. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement."

6. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

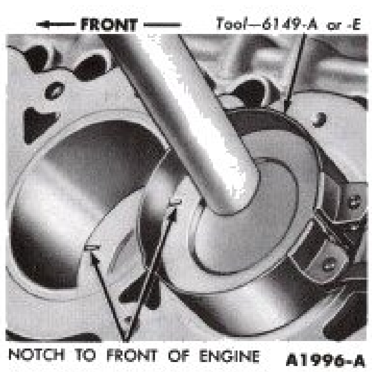


FIG. 45—Piston Installation

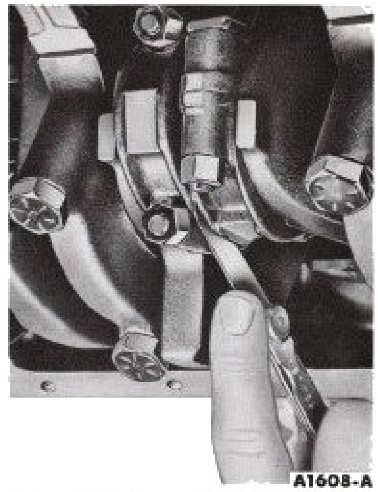


FIG. 46—Connecting Rod Side Clearance

7. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the connecting rod bearing seats on the crankshaft journal.

8. Install the connecting rod cap. Torque the nuts to specifications.

9. After the piston and connecting rod assemblies have been installed, check the side clearance between the connecting rods on each crankshaft journal (Fig. 46).

10. Disassemble, clean and assemble the oil pump. Clean the oil pump inlet tube screen, and the oil pan and block gasket surfaces.

11. Install the oil pump and the oil pan.

12. Install the cylinder heads following steps 1 thru 9 under "Cylinder Head Installation.

13. Install the intake manifold following steps 2 thru 15 under "Intake Manifold Installation."

14. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of engine oil.

15. Start the engine and check and adjust the ignition timing. Connect the distributor vacuum line at the carburetor.

16. Operate the engine at fast idle and check for oil and coolant leaks. Operate the engine until engine temperatures have stabilized and adjust the engine idle speed and idle fuel mixture.

On a car with power steering and air conditioning, adjust the speed-up

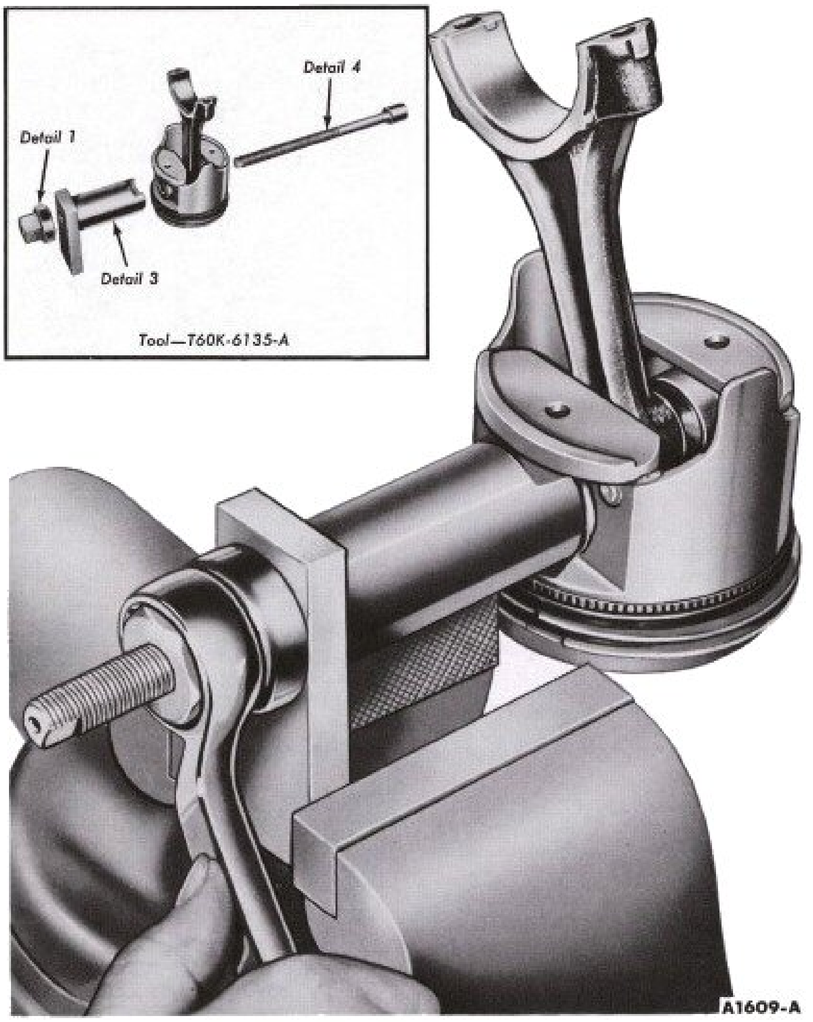


FIG. 47—Piston Pin Removal

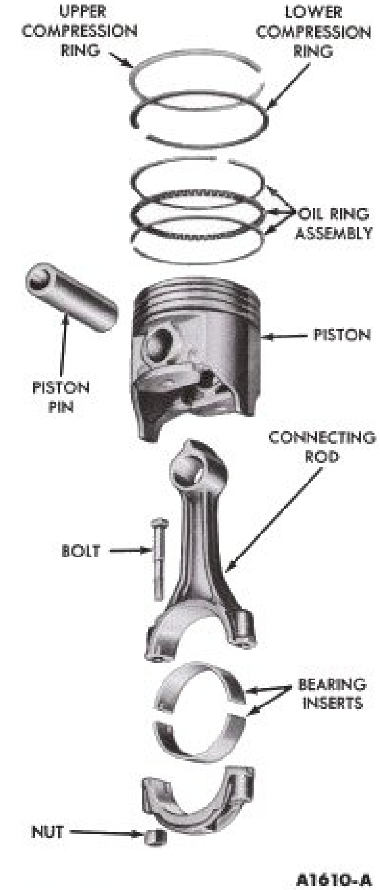


FIG. 48—Piston, Connecting Rod and Related Parts

control assembly as outlined in Group 3.

17. Adjust the transmission throttle linkage. Install the air cleaner and intake duct assembly.

18. Connect the automatic choke heat chamber air inlet hose.

DISASSEMBLY

1. Remove the bearing inserts from the connecting rod and cap.

2. Mark the pistons and pins to assure assembly with the same rod and installation in the same cylinders from which they were removed.

3. Remove the piston pin from the piston and connecting rod (Fig. 47). Remove the piston rings.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Refer to Part 8-1, Section 2 for the repair procedures.

ASSEMBLY

The piston, connecting rod and related parts are shown in Fig. 48. **Check the fit of a new piston in the cylinder bore before assembling the piston and piston pin to the connecting rod.**

The piston pin bore of a connecting rod and the diameter of the piston pin must be within specifications. Refer to Part 8-4.

1. Apply a light coat of engine oil to all parts. **Assemble the piston to the connecting rod with the oil squirt hole in the connecting rod and the indentation notch in the piston positioned as shown in Fig. 49.**

2. Start the piston pin in the piston and connecting rod. Draw the piston pin through the piston and connecting rod until the end of the pin seats in Detail 2 (Fig. 50).

3. Follow the instructions contained on the piston ring package and install the piston rings.

4. Check the ring side clearance of the compression rings with a feeler gauge inserted between the ring and its lower land. (Part 8-1,

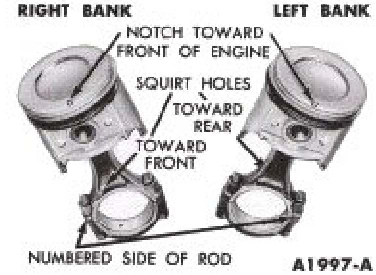


FIG. 49—Correct Piston and Rod Positions

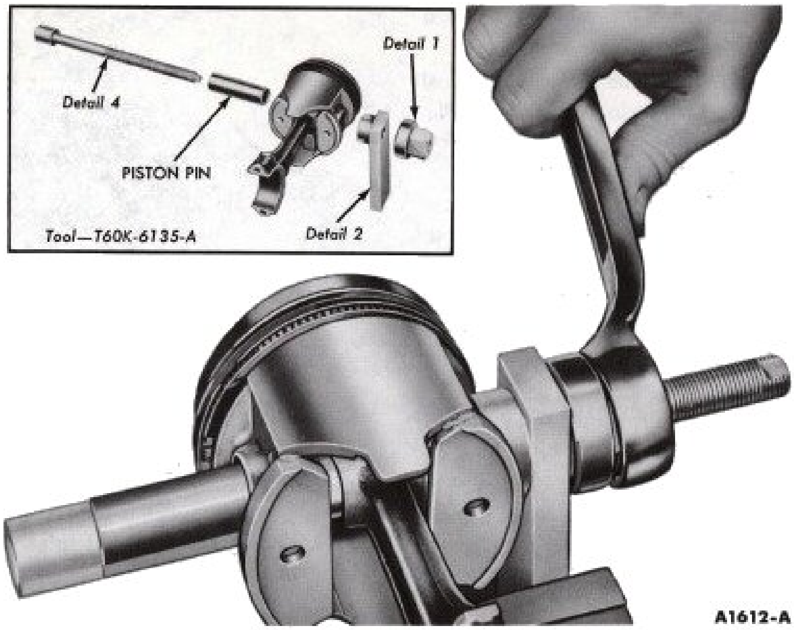


FIG. 50—Piston Pin Installation

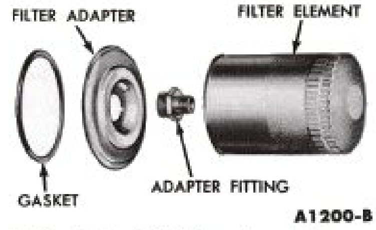


FIG. 51—Oil Filter Assembly

Section 2). The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. **If the lower lands have high steps, the piston should be replaced.**

5. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.

FLYWHEEL

REMOVAL

1. On a car with a manual-shift transmission, remove the transmission, clutch pressure plate and disc following the procedures in Group 5.

On a car with an automatic transmission, remove the transmission and converter housing following the procedure in Group 7.

2. Remove the flywheel retaining bolts and remove the flywheel.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures for manual-shift transmissions.

REPAIRS

To check flywheel face runout refer to Part 8-1, Section 1.

INSTALLATION

1. Coat the threads of the flywheel retaining bolts with oil-resistant sealer. Position the flywheel on the crankshaft flange. Install and torque the bolts in sequence across from each other to specifications.

2. On a car with a manual-shift transmission, install the clutch pressure plate, disc and the transmission following the procedures in Group 5.

On a car with an automatic transmission, install the transmission and converter housing following the procedure in Group 7.

CLUTCH PILOT BUSHING REPLACEMENT

1. Remove the transmission, clutch pressure plate and disc following the procedures in Group 5.

2. Remove the pilot bushing as shown in Fig. 66.

3. Coat the pilot bushing bore in the crankshaft with a small quantity of wheel bearing lubricant. **Avoid using too much lubricant as it may be thrown onto the clutch disc when the clutch revolves.**

4. Install the pilot service bearing as shown in Fig. 67.

5. Install the clutch pressure plate, disc and the transmission following the procedures in Group 5.

OIL FILTER REPLACEMENT

The Rotunda oil filter assembly is shown in Fig. 51.

1. Place a drip pan under the filter. Unscrew the filter from the adapter fitting and clean the adapter recess.

2. Coat the gasket on a new Rotunda filter with oil. Place the new Rotunda filter in position on the adapter fitting. Hand tighten the filter until the gasket contacts the adapter face, then advance it ½ turn.

3. Operate the engine at fast idle, and check for oil leaks. If oil leaks are evident, perform the necessary repairs to correct the leakage. Check the oil level and fill the crankcase if necessary.

OIL PAN

REMOVAL

1. Drain the crankcase. Remove the oil level dipstick.

2. Disconnect the starter cable at the starter. Remove the starter and dust seal.

3. Remove the oil pan retaining bolts and crank the engine as required to obtain clearance and remove the oil pan.

4. Remove the oil pump inlet tube and screen assembly.

5. Remove and discard the inlet tube to pump gasket.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Clean the oil pump inlet tube and screen assembly.

2. Using a new inlet tube to pump gasket, install the inlet tube and screen assembly.

3. Clean the gasket surfaces of the block and oil pan. The oil pan has a two-piece gasket. Coat the block surface and the oil pan gasket surface with sealer. Position the oil pan gaskets on the cylinder block (Fig. 52).

4. Position the oil pan front seal on the cylinder front cover (Fig. 52). **Be sure the tabs on the seal are over the oil pan gasket.**

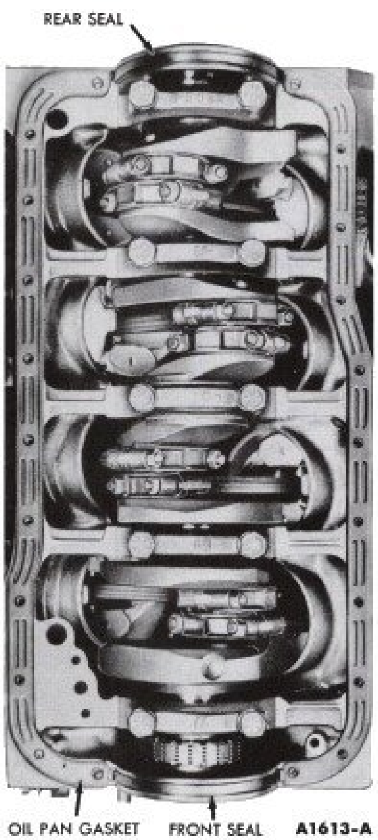


FIG. 52—Oil Pan Gaskets and Seals Installed

5. Position the oil pan rear seal on the rear main bearing cap (Fig. 52). **Be sure the tabs on the seal are over the oil pan gasket.**

6. Hold the oil pan in place against the block and install a bolt, finger-tight, on each side of the oil pan. Install the remaining bolts. Torque the bolts from the center outward in each direction to specifications.

7. Install the starter and dust seal. Connect the starter cable.

8. Fill the oil level dipstick. Fill the crankcase with the proper grade and quantity of engine oil. Operate the engine and check for oil leaks.

OIL PUMP

REMOVAL

1. Remove the oil pan and related parts as outlined under "Oil Pan Removal."

2. Remove the oil pump inlet tube and screen assembly. Discard the gasket.

3. Remove the oil pump retaining bolts and remove the oil pump, gasket and intermediate drive shaft.

INSTALLATION

1. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.

2. Position the intermediate drive shaft into the distributor socket. With the shaft firmly seated in the distributor socket, the stop on the shaft should touch the roof of the crankcase. Remove the shaft and position the stop as necessary.

3. Position a new gasket on the pump housing. With the stop properly positioned, insert the intermediate drive shaft into the oil pump. Install the pump and shaft as an assembly. **Do not attempt to force the pump into position if it will not seat readily. The drive shaft hex may be misaligned with the distributor shaft. To align, rotate the intermediate drive shaft into a new position.** Torque the oil pump retaining screws to specifications.

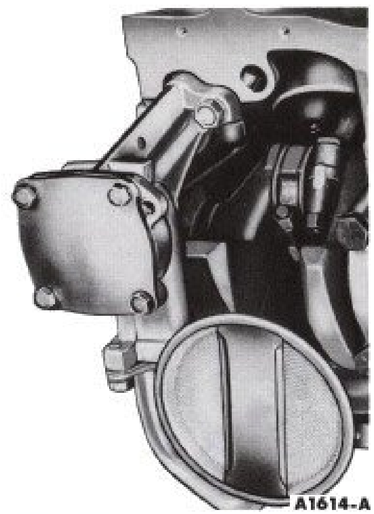


FIG. 53—Oil Pump and Inlet Tube Installed

4. Clean the oil pump inlet tube and screen assembly (Fig. 53).

5. Using a new gasket, install the oil pump inlet tube and screen assembly.

6. Install the oil pan and related parts as outlined under "Oil Pan Installation."

DISASSEMBLY

1. Remove the oil inlet tube from the oil pump and remove the gasket.

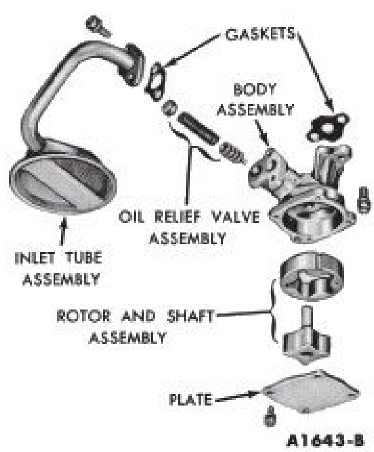


FIG. 54—Oil Pump Assembly

2. Remove the cover retaining screws, then remove the cover. Remove the inner rotor and shaft assembly, then remove the outer race.

3. Insert a self-threading sheet metal screw of the proper diameter into the oil pressure relief valve chamber cap and pull the cap out of the chamber. Remove the spring and plunger.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

ASSEMBLY

The oil pump assembly is shown in Fig. 54.

1. Oil all parts thoroughly.

2. Install the oil pressure relief valve plunger, spring and a new cap.

3. Install the outer race, and the inner rotor and shaft assembly. **The inner rotor and shaft, and the outer race are serviced as an assembly. One part should not be replaced without replacing the other.** Install the cover and torque the cover retaining screws to specifications.

4. Position a new gasket and the oil inlet tube on the oil pump and install the retaining bolts.

3 ENGINE REMOVAL AND INSTALLATION

The engine removal and installation procedures are for the engine only without the transmission attached.

REMOVAL

1. Drain the cooling system and the crankcase. Remove the oil filter.

2. Remove the hood. Disconnect the battery ground cable at the cylinder head.

3. Disconnect the automatic choke heat chamber air inlet hose at the inlet tube near the right valve rocker arm cover. **Do not remove the air inlet hose at the air cleaner.** Remove the air cleaner and intake duct assembly.

4. Disconnect the radiator upper hose at the coolant outlet housing and the radiator lower hose at the water pump.

On a car with an automatic transmission, disconnect the transmission oil cooler lines at the radiator.

5. Remove the radiator. Remove the fan, spacer, belt and pulley.

6. Disconnect the wires at the generator or alternator. Loosen the generator or alternator adjusting bolts to allow the generator or alternator to swing down and out of the way.

7. Disconnect the oil pressure sending unit wire at the sending unit, and the flexible fuel line at the fuel tank line. Plug the fuel tank line.

8. Disconnect the accelerator rod at the bellcrank.

On a car with an automatic transmission, disconnect the throttle valve vacuum line at the intake manifold. Disconnect the manual shift rod at the bellcrank and remove the retracting spring. Disconnect the transmission filler tube bracket at the cylinder block.

On a car with an air conditioner, isolate and remove the compressor as outlined in Group 16.

On a car with power steering and air conditioning, remove the speed-up control assembly from the bellcrank assembly.

On a car with power steering, disconnect the power steering pump bracket from the cylinder head. Remove the drive belt. Wire the power steering pump out of the way and in a position that will prevent the oil from draining out. Disconnect the brake vacuum line at the intake manifold.

9. Remove the heater hose from the automatic choke housing. Disconnect the heater hoses at the water pump and intake manifold. Disconnect the water temperature sending unit wire at the sending unit.

10. Remove the flywheel or converter housing to engine upper bolts.

11. Disconnect the primary wire at the ignition coil and position the wire out of the way. Disconnect the ground strap at the block.

12. Raise the front of the car. Disconnect the starter cable at the starter. Remove the starter and dust seal.

13. Disconnect the muffler inlet pipes from the exhaust manifolds. Disconnect the engine support insulators at the brackets on the frame underbody.

On a car with a manual-shift transmission, remove the remaining flywheel housing to engine bolts. Disconnect the clutch pedal retracting spring. Remove the clutch equalizer bar bracket retaining bolts and remove the clutch release rod at the release lever.

On a car with an automatic transmission, remove the converter housing inspection cover. Disconnect the flywheel from the converter. Secure the converter assembly in the housing. Remove the remaining converter housing to engine bolts.

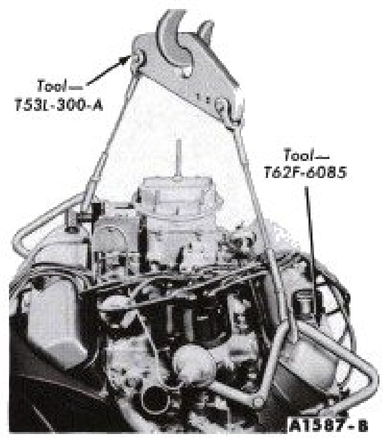


FIG. 55—Engine Lifting Brackets and Sling

14. Lower the car, then support the transmission. Install the engine left lifting bracket an the front of the left cylinder head, and install the engine right lifting bracket at the rear of the right cylinder head, then attach the engine lifting sling (Fig. 55).

15. Raise the engine slightly and carefully pull it from the transmission. Carefully lift the engine out of the engine compartment so that the rear cover plate is not bent or other components damaged. Install the engine on a work stand.

INSTALLATION

1. Position new gaskets on the muffler inlet pipes.

2. Attach the engine lifting brackets and sling (Fig. 55). Remove the engine from the work stand.

3. Lower the engine carefully into the engine compartment. Make sure

the exhaust manifolds are properly aligned with the muffler inlet pipes and the dowels in the block are through the rear cover plate and engage the holes in the flywheel housing.

On a car with an automatic transmission, start the converter pilot into the crankshaft.

On a car with a manual-shift transmission, start the transmission main drive gear into the clutch disc. It may be necessary to adjust the position of the transmission in relation to the engine if the input shaft will not enter the clutch disc. **If the engine "hangs up" after the shaft enters, turn the crankshaft slowly (transmission in gear) until the shaft splines mesh with the clutch disc splines.**

4. Install the flywheel or converter housing upper bolts.

5. Install the engine support insulator to bracket retaining nuts. Disconnect the engine lifting sling and remove the lifting brackets.

6. Raise the front of the car. Connect both exhaust manifolds to the muffler inlet pipes. Torque the nuts to specifications.

7. Position the dust seal and install the starter.

On a car with a manual-shift transmission, install the remaining flywheel housing to engine bolts. Connect the clutch release rod. Position the clutch equalizer bar and bracket and install the retaining bolts. Install the clutch pedal retracting spring.

On a car with an automatic transmission, remove the retainer securing the converter in the housing. Attach the converter to the flywheel. Install the converter housing inspection cover. Install the remaining converter housing retaining bolts.

8. Remove the support from the transmission and lower the car.

9. Connect the engine ground strap and coil primary wire.

10. Connect the water temperature sending unit wire. Install the heater hose on the automatic choke housing and connect the hose at the intake manifold.

11. Connect the accelerator rod at the bellcrank.

On a car with an automatic transmission, connect the transmission filler tube bracket. Connect the manual shift rod and install the retracting spring. Connect the throttle valve vacuum line.

On a car with an air conditioner, install the compressor as outlined in Group 16.

On a car with power steering and air conditioning, install the speed-up control assembly on the bellcrank assembly.

On a car with power steering, install the drive belt and power steering pump bracket. Install the bracket retaining bolts. Adjust the drive belt tension to specifications. Connect the brake vacuum line.

12. Remove the plug from the fuel tank line. Connect the flexible fuel line and the oil pressure sending unit wire.

13. Install the pulley, belt, spacer and fan. Adjust the belt tension to specifications.

14. Tighten the generator or alternator adjusting bolts. Connect the generator or alternator wires and the battery ground cable.

15. Install the radiator. Connect the radiator upper and lower hoses.

On a car with an automatic transmission, connect the transmission oil cooler lines.

16. Install the oil filter. Fill and bleed the cooling system. Connect the heater hose at the water pump. Fill the crankcase with the proper grade and quantity of oil.

17. Adjust the transmission throttle linkage.

On a car with power steering and air conditioning, adjust the speed-up control assembly as outlined in Group 3.

18. Operate the engine at fast idle and check all gaskets and hose connections for leaks.

19. Install the air cleaner and intake duct assembly. Connect the automatic choke heat chamber air inlet hose.

20. Install and adjust the hood.

4 MAJOR REPAIR OPERATIONS

To perform the operations in this section, it will be necessary to remove the engine from the car and install it on a work stand.

CRANKSHAFT

The crankshaft and related parts are shown in Fig. 56.

REMOVAL

1. Disconnect the spark plug wires at the spark plugs and remove the wires from the ignition harness brackets on the valve rocker arm covers. Remove the distributor cap and spark plug wire assembly. Remove the spark plugs to allow easy rotation of the crankshaft.

2. Remove the fuel pump and oil filter. Slide the water pump bypass hose clamp toward the water pump. Remove the generator or alternator, shield and mounting bracket.

3. Remove the crankshaft pulley from the crankshaft vibration damper. Remove the cap screw and washer from the end of the crankshaft. Install the puller on the crankshaft vibration damper (Fig. 39) and remove the damper.

4. Remove the cylinder front cover and water pump as an assembly.

5. Remove the crankshaft front oil slinger. Check the timing chain deflection, then remove the timing chain and sprockets by following steps 12 thru 16 under "Cylinder Front Cover and Timing Chain Removal."

6. Invert the engine on the work stand. Remove the clutch pressure plate and disc (manual-shift transmission). Remove the flywheel. Remove the oil pan and gasket. Remove the oil pump.

7. Make sure all bearing caps (main and connecting rod) are marked so that they can be installed in their original locations. Turn the crankshaft until the connecting rod from which the cap is being removed is down and remove the bearing cap. Push the connecting rod and piston assembly up into the cylinder. Repeat this procedure until all the connecting rod bearing caps are removed.

8. Remove the main bearing caps.

9. Carefully lift the crankshaft out of the block so that the thrust

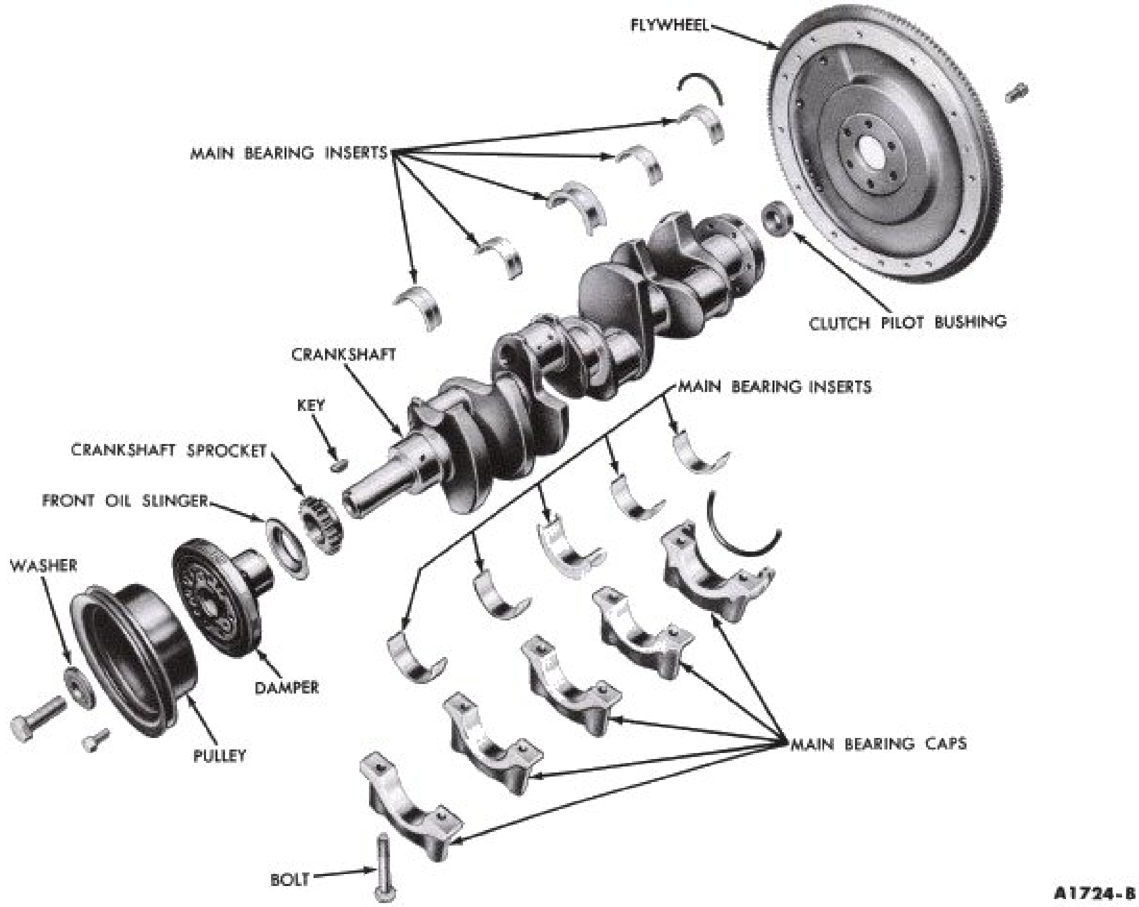


FIG. 56—Crankshaft and Related Parts

bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

To refinish journals, dress minor imperfections, etc., refer to Part 8-1, Section 2.

INSTALLATION

1. Remove the rear journal oil seal from the block and rear main bearing cap.

2. Remove the main bearing inserts from the block and bearing caps.

3. Remove the connecting rod bearing inserts from the connecting rods and caps.

4. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing inserts and bearing bores are clean. Foreign material under the inserts may distort the bearing and cause a failure.

5. Place the upper main bearing inserts in position in the bores with the tang fitting in the slot provided.

6. Install the lower main bearing inserts in the bearing caps.

7. Clean the rear journal oil seal groove and the mating surfaces of the block and rear main bearing cap. Preform the new seal by hand to the approximate radius of the cap.

8. Insert the seal in the oil seal groove, seating the center of the seal first and allowing the seal to extend equally on both ends. Press the seal down firmly with the thumb at the center of the seal, then press both ends of the seal into the groove, working from the ends to the center.

9. Position the seal forming tool as shown in Fig. 57 and complete the seal installation. After installation, cut the ends of the seal flush.

10. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**

11. Check the clearance of each main bearing as follows:

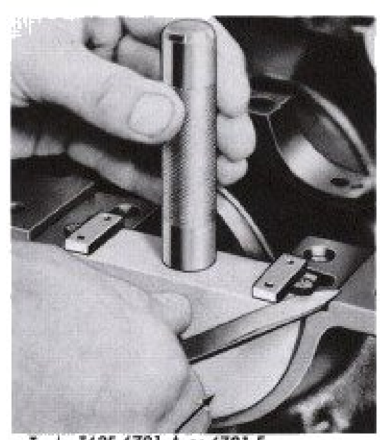


FIG. 57—Rear Oil Seal to Block Installation

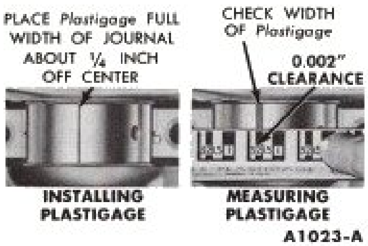


FIG. 58—Installing and Measuring Plastigage—Engine on Work Stand

Place a piece of Plastigage on the crankshaft journal the full width of the journal and about ¼ inch off-center (Fig. 58). Follow steps 11 thru 15 under "Main Bearing Replacement."

12. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install a new seal in the rear main bearing cap and install the rear main bearing cap by following steps 17 thru 20 under "Main Bearing Replacement." Install all the bearing caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original locations.** Torque the bearing cap bolts to specifications.

13. Install the thrust bearing cap with the bolts finger-tight.

14. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 59).

15. Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 59). This will align the thrust surfaces of both halves of the bearing.

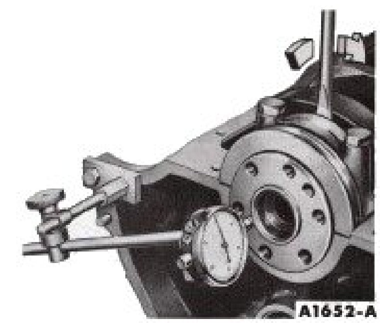


FIG. 60—Crankshaft End Play

16. Retain the forward pressure on the crankshaft. Tighten the cap bolts to specifications (Fig. 59).

17. Force the crankshaft toward the rear of the engine.

18. Install a dial indicator so that the contact point rests against the crankshaft flange and the indicator axis is parallel to the crankshaft axis (Fig. 60).

19. Zero the dial indicator. Push the crankshaft forward and note the reading on the dial.

20. If the end play exceeds the wear limit, replace the thrust bearing. If the end play is less than the minimum limit, inspect the thrust bearing faces for scratches, burrs, nicks or dirt. If the thrust faces are not defective or dirty, they probably were not aligned properly. Install the thrust bearing and align the faces following the recommended procedure (steps 13, 14, 15 and 16), then check the end play.

21. Install new bearing inserts in the connecting rods and caps. Check the clearance of each bearing following the recommended procedure.

22. After the connecting rod bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

23. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the rod bearing seats on the crankshaft journal.

24. Install the connecting rod cap. Torque the nuts to specifications.

25. After the piston and connecting rod assemblies have been installed, check the side clearance between the connecting rods on each connecting rod crankshaft journal (Fig. 46).

26. Clean the oil pan, oil pump and oil pump screen. Install the oil pump and oil pan.

27. Coat the threads of the flywheel retaining bolts with oil-resistant sealer. Position the flywheel on the crankshaft flange. Install and torque the bolts to specifications.

On a flywheel for a manual-shift transmission, use tool 6392-N to locate the clutch disc. Install the pressure plate. Tighten the retaining bolts.

28. Install the timing chain and sprockets, cylinder front cover and crankshaft pulley and adapter, following steps 1 thru 6 under "Cylinder Front Cover and Timing Chain Installation."

29. Install the Rotunda oil filter, fuel pump and connect the fuel lines. Install the generator or alternator, shield and mounting bracket.

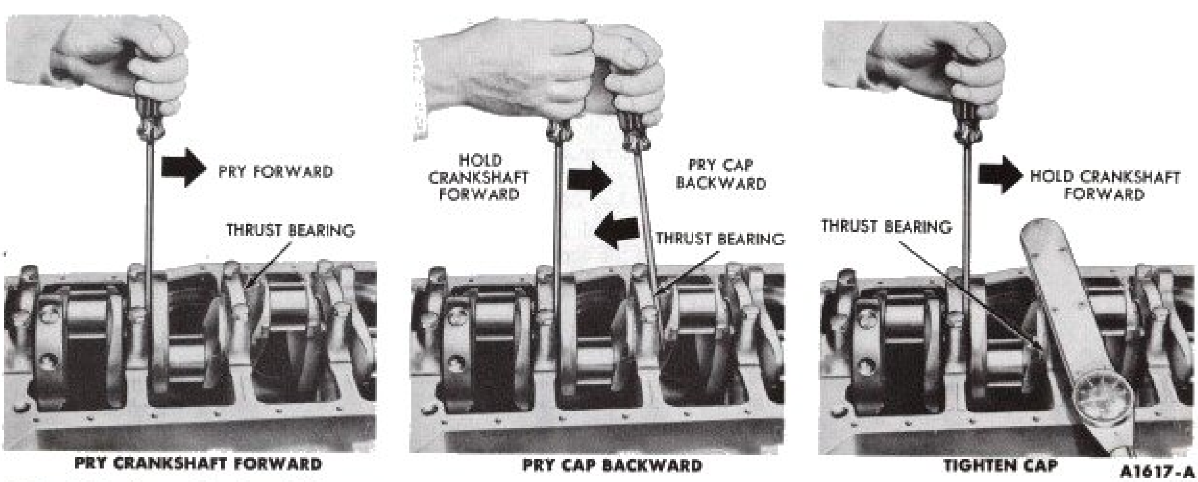


FIG. 59—Thrust Bearing Alignment

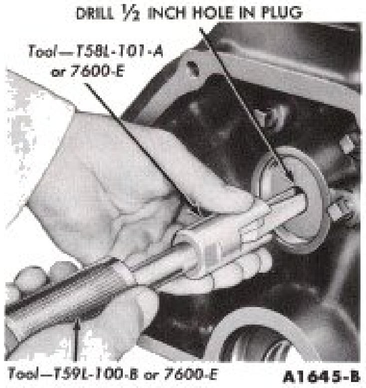


FIG. 61—Camshaft Rear Bearing Bore Plug Removal

30. Install the spark plugs, distributor cap and spark plug wires. Connect the spark plug wires and high tension lead.

31. Install the engine in the car.

CAMSHAFT BEARING REPLACEMENT

Camshaft bearings are available pre-finished to size for standard and 0.015-inch undersize journal diameters. The bearings are not interchangeable from one bore to another.

1. Remove the camshaft, the flywheel, engine rear cover plate and the crankshaft. Push the pistons to the top of the cylinders.

2. Remove the camshaft rear bearing bore plug (Fig. 61). Remove the camshaft bearings (Fig. 62).

3. Position the new bearings at the bearing bores, and press them in place with the tool shown in Fig. 62. Align the oil holes in the bearings with the oil holes in the cylinder block when the bearings are installed. **Be sure the front bearing is installed 0.005-0.020 inch below the front face of the cylinder block (Fig. 63).**

4. Clean out the camshaft rear bearing bore plug recess thoroughly. Coat the flange of a new plug with oil-resistant sealer and install the plug with the cup side facing out. Drive the plug in until it is slightly below the chamfer in the bore (Fig. 64).

5. Install the camshaft, crankshaft, flywheel and related parts. Install the engine in the car.

ENGINE DISASSEMBLY

1. Install the engine on the work-stand.

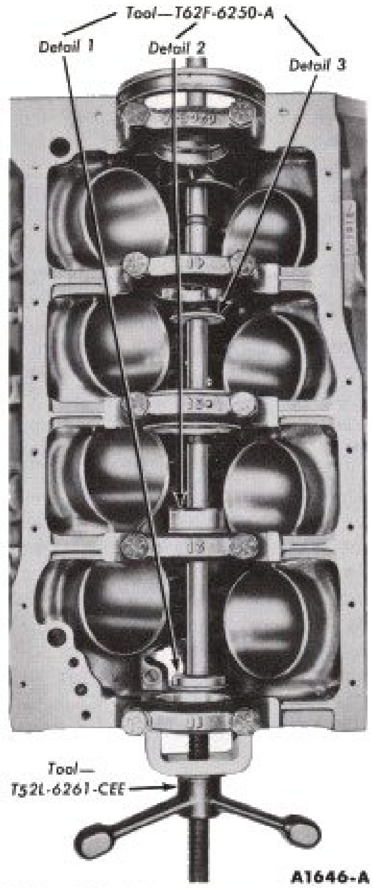


FIG. 62—Camshaft Bearing Replacement

2. Remove the distributor cap and spark plug wire assembly.

3. Disconnect the distributor vacuum line at the distributor. Remove the carburetor fuel inlet line and fuel pump outlet line. Remove the fuel pump and discard the gasket. Remove the oil filter.

4. Slide the clamp on the water pump bypass hose toward the water pump. Remove the automatic choke-heat tube.

5. Disconnect the crankcase vent hose at the carburetor and regulator valve. Remove the regulator valve from the valve rocker arm cover. Remove the valve rocker arm covers.

6. Remove the generator or alternator, shield and mounting bracket. Remove the ignition coil. Remove the distributor hold down bolt and remove the distributor.

7. Remove the intake manifold retaining bolts. Raise the manifold and carefully remove it from the

FIG. 63—Camshaft Front Bearing Measurement

engine. Discard the intake manifold gaskets, seals and sealing washers.

8. Loosen the valve rocker arm stud nuts so that the valve rocker arms can be rotated to the side. Remove the valve push rods in sequence and put them in a rack or holder so that they can be installed in their original position.

9. Using a magnet, remove the valve lifters and place them in a rack so that they can be installed in their original bores (Fig. 41).

If the valve lifters are stuck in their bores by excessive varnish, etc., it may be necessary to use a plier-type tool (T52T-6500-DJD or 6500-D) to remove the lifters. Rotate the lifter back and forth to loosen it from the gum or varnish that may have formed at the lifter.

The internal parts of each hydraulic valve lifter assembly are matched sets. Do not intermix the parts. Keep the assemblies intact until they are to be cleaned.

10. Remove the exhaust manifolds and the spark plugs.

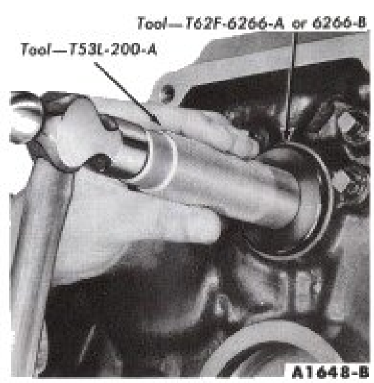


FIG. 64—Camshaft Rear Bearing Bore Plug Installation

11. Install the cylinder head holding fixtures (Fig. 25). Remove the cylinder head bolts and lift the cylinder heads off the block. **Do not pry between the head and the block.** Discard the cylinder head gaskets.

12. Remove the crankshaft pulley from the crankshaft vibration damper. Remove the cap screw and washer from the end of the crankshaft. Install the puller on the crankshaft vibration damper (Fig. 32) and remove the vibration damper.

13. Remove the oil pan to cylinder front cover retaining bolts. Remove the cylinder front cover retaining screws (one screw retains the fuel line bracket). Remove the cylinder front cover and water pump as an assembly. Discard the gasket and remove the crankshaft front oil slinger.

14. Check the timing chain deflection and remove the timing chain and sprockets by following steps 12 thru 16 under "Cylinder Front Cover and Timing Chain Removal." Remove the crankshaft sprocket key.

15. Remove any ridge and/or carbon deposits from the upper end of the cylinder bores. Move the piston to the bottom of its travel and place a cloth on the piston head to collect the cuttings. Remove the cylinder ridge with a ridge cutter. Follow the instructions furnished by the tool manufacturer. **Never cut into the ring travel area in excess of 1/32 inch when removing ridges.** After the ridge has been removed, remove the cutter from the cylinder bore.

On a flywheel for a manual-shift transmission, remove the clutch pressure plate and disc.

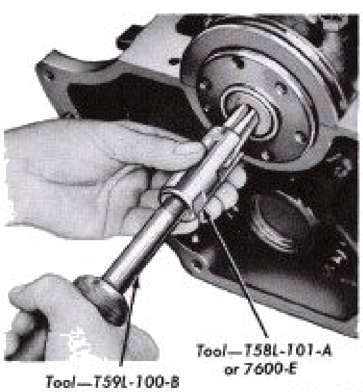


FIG. 65—Clutch Pilot Bushing Removal

16. Remove the flywheel and rear cover plate. Remove the clutch pilot bushing (Fig. 65).

17. Invert the engine Remove the oil pan and discard the gaskets and seals.

18. Remove the oil pump and inlet tube as an assembly. Remove the intermediate drive shaft. Discard the oil pump gasket.

19. Make sure all connecting rods and caps are marked so that they can be installed in their original locations. Turn the crankshaft until the connecting rod being removed is down. Remove the rod cap.

20. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a hammer. **Avoid damage to the connecting rod journal or the cylinder wall when removing the piston and rod.**

21. Remove the bearing inserts from the connecting rods and caps. Install the rod caps on the connecting rods from which they were removed.

22. Remove the main bearing caps.

23. Carefully lift the crankshaft out of the cylinder block so that the thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

24. Remove the rear journal oil seal from the block and rear bearing cap.

25. Remove the main bearing inserts from the block and bearing caps. Install the main bearing caps in their original positions.

26. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. Use caution to avoid damaging the journals and lobes.

27. Remove the camshaft rear bearing bore plug (Fig. 61). Remove the camshaft bearings (Fig. 62).

ENGINE ASSEMBLY

1. Remove the glaze from the cylinder bores by following the instructions of the tool manufacturer.

2. Invert the engine on the work stand.

3. Position the new camshaft bearings at the bearing bores, and press them in place with the tool shown in Fig. 62. Align the oil holes in the cylinder block when the bearings are installed. **Be sure the camshaft front bearing is installed 0.005-0.020 inch below the front face of the cylinder block (Fig. 63).**

4. Clean out the camshaft rear bearing bore plug recess thoroughly. Coat the flange of a new plug with oil-resistant sealer and install it with the cup side facing out (Fig. 64). Drive the plug in until it is slightly below the chamfer in the bore.

5. Oil the camshaft journals and apply Lubriplate to all lobes, then carefully slide it through the bearings.

6. Clean the rear journal oil seal groove and the mating surfaces of the block and rear main bearing cap. Preform the new seal by hand to the approximate radius of the cap.

7. Insert the seal in the oil seal groove, seating the center of the seal first and allowing the seal to extend equally on both ends. Press the seal down firmly with the thumb at the center of the seal, then press both ends of the seal into the groove, working from the ends to the center.

8. Position the seal forming tool as shown in Fig. 57 and complete the seal installation. After installation, cut the ends of the seal flush.

9. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing inserts and bearing bores are clean. Foreign material under the inserts may distort the bearing and cause a failure.

Place the upper main bearing inserts in position in the bore with the tang fitting in the slot provided.

10. Install the lower main bearing inserts in the bearing caps.

11. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**

12. Check the clearance of each main bearing following the procedure under "Main Bearing Replacement."

13. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

14. Install a new journal seal in the cap (Fig. 44) by following steps 6, 7 and 8. Apply a thin coating of oil-resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 44.) **Do not apply sealer to the area forward of the oil slinger groove.** Install the rear

main bearing cap and the remainder of the caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original positions.** Torque the bearing cap bolts to specifications.

15. Install the thrust bearing cap and check crankshaft end play by following steps 13 thru 20 under "Crankshaft Installation."

16. Turn the engine on the work stand so that the front end is up.

17. Install the pistons and connecting rods by following steps 1 thru 9 under "Piston and Connecting Rod Installation."

18. Position the sprockets and timing chain on the camshaft and crankshaft (Fig. 35). Be sure the timing marks on the sprockets are positioned as shown in Fig. 34.

19. Lubricate the timing chain and sprockets with engine oil.

20. Install the fuel pump eccentric, washer and camshaft sprocket cap screw. Torque the sprocket cap screw to specifications. Install the crankshaft front oil slinger (Fig. 37).

21. Clean the cylinder front cover and the cylinder block gasket surfaces. Install a new crankshaft front oil seal (Fig. 36).

22. Coat the gasket surface of the block and cover and the cover bolt threads with sealer. Position a new gasket on the block.

23. Install the alignment pilot tool on the cylinder front cover so that the keyway in the pilot aligns with the key in the crankshaft. Position the cover (and water pump) and pilot over the end of the crankshaft and against the block (Fig. 69).

24. Install the cylinder front cover screws finger-tight (one screw retains the fuel line bracket). While pushing in on the pilot, torque the cover bolts to specifications. Remove the pilot.

25. Lubricate the crankshaft with a white lead and oil mixture and lubricate the oil seal rubbing surface with grease.

26. Line up the crankshaft vibration damper keyway with the key on the crankshaft, then install the vibration damper on the crankshaft (Fig. 39). Install the damper cap screw and washer, and torque the screw to specifications. Install the crankshaft pulley.

27. Using a new gasket, install the fuel pump.

28. Turn the engine on the work stand so that the top of the engine is up.

29. Clean the cylinder head and block gasket surfaces. Install the head gasket over the cylinder head dowls.

30. Place the cylinder head on the engine, then remove the holding fixtures. Coat the head bolt threads with water-resistant sealer, and then install the bolts.

31. The cylinder head bolt tightening procedure is performed in three progressive steps. Torque the bolts in sequence (Fig. 26) to 50 ft-lbs, then to 60 ft-lbs and finally to 70 ft-lbs. **After the cylinder head bolts have been torqued to specifications, the bolts should not be disturbed.**

32. Coat the mating surfaces of the exhaust manifold with a light film of graphite grease. Position new gaskets on the muffler inlet pipe.

33. Position the exhaust manifolds on the cylinder heads and install the retaining bolts and tab washers. Torque the retaining bolts to specifications, working from the center to the ends. Lock the bolts by bending one tab of the washer over a flat on the bolt.

34. Install the spark plugs.

35. Coat the outside of each valve lifter with engine oil to provide initial lubrication. **Do not fill the lifters with oil. The lifters will fill much faster after the engine is started, if they are free of any oil film which may cause an oil seal between the plunger and the lifter body.** Place each lifter in the bore from which it was removed.

36. Install the push rods in their original positions. Apply Lubriplate over the valve stem tips and the push rod guides in the cylinder head. Install the rocker arms over the push rods. Perform a valve clearance adjustment as outlined in Part 8-1, Section 2.

37. Clean the mating surfaces of the intake manifold, cylinder heads and cylinder block.

38. Coat the intake manifold and cylinder block seal surfaces with oil-resistant sealer.

39. Position new seals on the cylinder block and new gaskets on the cylinder heads with the gaskets interlocked with the seal tabs. Be sure the holes in the gaskets are aligned with the holes in the cylinder heads. The correct installation of the gaskets and seals is shown in Fig. 18.

40. Carefully lower the intake manifold on the cylinder block and cylinder heads. **After the intake manifold is in place, run a finger around the seal area to make sure the seals are in place. If the seals are not in place, remove the intake manifold and position the seals.**

41. Be sure the holes in the manifold gaskets and manifold are in alignment. Position the intake manifold alignment tools (Fig. 17) in the front and rear (Nos. 10 and 12) bolt holes on the left bank of the manifold.

42. Using new sealing washers, install the intake manifold retaining bolts. Working from the center to the ends, torque the bolts in sequence (Fig. 19) to 3-5 ft-lbs.

43. Remove the manifold alignment tools from the front and rear bolt holes (Nos. 10 and 12). Using new sealing washers, install the two remaining bolts and torque to 3-5 ft-lbs.

44. Torque all the manifold retaining bolts in sequence to 11-14 ft-lbs. Finally, torque all the retaining bolts in sequence to 12-15 ft-lbs.

45. Install the water pump bypass hose on the coolant outlet housing. Slide the clamp into position and tighten the clamp.

46. Rotate the crankshaft until the No. 1 piston is on TDC after the compression stroke, then position the distributor in the block with the rotor at the No. 1 firing position and the points open. Install the hold down clamp.

47. Install the ignition coil. Position and install the generator or alternator, shield and mounting bracket.

48. Clean the valve rocker arm covers and the cylinder head gasket surface. Apply oil-resistant sealer to one side of new cover gaskets. Lay the cemented side of the gaskets in place in the covers.

49. Position the covers on the cylinder heads. Make sure the gasket seats evenly all around the head. Install the bolts. The cover is tightened in two steps. Torque the bolts to specifications. Two minutes later, torque the bolts to the same specifications.

50. Insert the crankcase ventilation regulator valve in the valve rocker arm cover mounting grommet. Connect the crankcase vent hose to the carburetor spacer and regulator valve.

51. Install the automatic choke heat tube. Install the distributor cap. Position the spark plug wires in the brackets on the valve rocker arm covers. Connect the spark plug wires.

52. Connect the carburetor fuel inlet line and pump inlet line.

53. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.

54. Invert the engine on the work stand. Position the intermediate drive shaft into the distributor socket. With the shaft firmly seated in the distributor socket, the stop on the shaft should touch the roof of the crankcase. Remove the shaft and position the stop as necessary.

55. With the stop properly positioned, insert the intermediate drive shaft into the oil pump.

56. Position a new gasket on the pump housing and install the pump and shaft as an assembly. **Do not attempt to force the pump into position if it will not seat readily. The drive shaft hex may be misaligned with the distributor shaft. To align, rotate the intermediate shaft into a new position.** Torque the oil pump retaining screws to specifications.

57. Clean the gasket surfaces of the block and oil pan. Coat the block surface and the oil pan gasket surface with sealer. Position new gaskets on the block and position a new seal on the cylinder front cover and rear main bearing cap. Make sure the tabs on the seal are over the oil pan gasket. Install the retaining screws and torque them from the center outward to specifications (one screw retains the fuel line bracket).

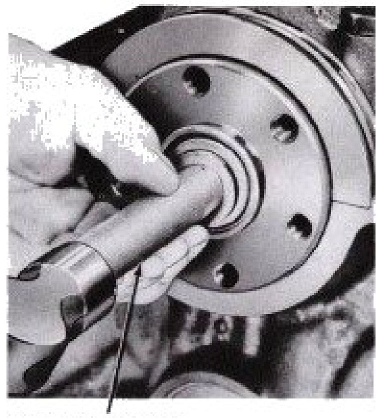


FIG. 66—Clutch Pilot Bearing Installation

58. Clean the oil filter adapter gasket surface. Coat the gasket on the filter with oil. Place the Rotunda filter in position on the adapter fitting. Hand tighten the filter until the gasket contacts the adapter face, then advance it ½ turn.

59. Install the clutch pilot service bearing (Fig. 66). Coat the threads of the flywheel retaining bolts with oil-resistant sealer. Postion the rear cover plate on the block and the flywheel on the crankshaft flange. Install and torque the bolts to specifications.

On a flywheel for a manual-shift transmission, use tool T58P-7563-A to locate the clutch disc. Install the pressure plate.

60. Install the engine in the car. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of engine oil.

61. Operate the engine and check for oil and coolant leaks. Check and adjust the ignition timing. Connect the distributor vacuum line at the distributor.

62. Adjust the engine idle speed, fuel mixture and anti-stall dashpot (if applicable). Adjust the transmission throttle linkage.

On a car with power steering and air conditioning, adjust the speed-up control assembly as outlined in Group 3.

PART 8-4 SPECIFICATIONS

NOTE: All specifications are given in inches unless otherwise noted.

GENERAL ENGINE

MODEL PREFIX

144	EEN
170	EET
200	EFZ
260	EEY
289	EGA

ENGINE MODELS AND PISTON DISPLACEMENT—Cubic Inches

144 Six	144
170 Six	170
200 Six	200
260 V-8	260
289 V-8	289

COMPRESSION RATIO

144, 170 and 200 Six	8.7:1
260 V-8	8.8:1
289 V-8	9.0:1

BRAKE HORSEPOWER @ Specified rpm

144 Six	85 @ 4200
170 Six	101 @ 4400
200 Six	116 @ 4400
260 V-8	164 @ 4400
289 V-8	210 @ 4400

TORQUE—Ft-lbs @ Specified rpm

144 Six	134 @ 2000
170 Six	156 @ 2400
200 Six	175 @ 2400
260 V-8	258 @ 2200
289 V-8	300 @ 2800

BORE AND STROKE

144 Six	3.50 x 2.500
170 Six	3.50 x 2.940
200 Six	3.68 x 3.126
260 V-8	3.80 x 2.870
289 V-8	4.00 x 2.870

COMPRESSION PRESSURE*—Sea Level @ Cranking Speed

144, 170 and 200 Six	150-190
260 and 289 V-8	130-170
*Allowable tolerance between cylinders	± 20 psi

TAXABLE HORSEPOWER

144 and 170 Six	29.40
200 Six	32.50
260 V-8	46.20
289 V-8	51.20

FIRING ORDER

144, 170 and 200 Six	1-5-3-6-2-4
260 and 289 V-8	1-5-4-2-6-3-7-8

VALVE ARRANGEMENT—Front to Rear

All Six's	E-I-I-E-I-E-E-I-E-I-I-E
All V-8	Right I-E-I-E-I-E-I-E
	Left E-I-E-I-E-I-E-I

ENGINE IDLE RPM*

Manual-Shift Transmissions

144 and 170 Six	500-525
260 and 289 V-8	575-600

Automatic Transmissions—Drive Range

All Six's	500-525
All V-8	475-500

*If unit is equipped with air conditioner, it should be operated at least 20 minutes before setting engine idle speed.

ENGINE IDLE MANIFOLD VACUUM—Minimum Inches of Mercury @ Specified Engine Neutral Idle rpm (Sea Level)

144 Six and 260 V-8	16
170 and 200 Six	17
289 V-8	18

GENERAL ENGINE (Continued)

INITIAL IGNITION TIMING—BTC**

Manual-Shift Transmission

144 Six	8°*
170 Six	6°*
260 and 289 V-8	6°

Automatic Transmission

144, 170 and 200 Six	12°*
260	10°
289	8°

*For altitude operation, and/or to obtain optimum engine performance and fuel economy, the initial ignition timing may be advanced 5° over the "normal" setting. No further improvement in engine performance or fuel economy will be achieved by advancing beyond this point. Advance the timing progressively until engine detonation (spark knock) is evident under actual road test acceleration. Retard the timing until the detonation (spark knock) is eliminated.

**If the individual requirements of the car and/or the use of sub-standard fuels dictate, the initial timing may have to be retarded from the recommended setting to eliminate detonation (spark knock). If retarding is necessary, it should be done progressively and not to exceed 2° BTC.

OIL CAPACITY*	U.S. MEASURE	IMPERIAL MEASURE
144, 170 and 200 Six	4.50 quarts	3.75 quarts
260 and 289 V-8	5.00 quarts	4.25 quarts

*Includes one U.S. quart required with oil filter replacement.

OIL PRESSURE—Hot @ 2000 rpm

All Engines	35-55 psi

CYLINDER HEAD

GASKET SURFACE FLATNESS

144, 170 and 200	0.003 inch in any 6 inches or 0.007 inch overall
260 and 289	0.003 inch in any 6 inches or 0.006 inch overall

VALVE GUIDE BORE DIAMETER—Standard

Intake and Exhaust

144, 170 and 200	0.3115-0.3125
260 and 289	0.3433-0.3443

VALVE SEAT WIDTH

Intake and Exhaust

144, 170 and 200	0.070-0.080
260 and 289	0.060-0.080

VALVE SEAT ANGLE

Intake and Exhaust

All Engines	45°

VALVE SEAT RUNOUT

Maximum 260 and 289	0.0015
Maximum Other Engines	0.002

ROCKER ARM STUD BORE DIAMETER

260 and 289	0.3685-0.3695

COMBUSTION CHAMBER VOLUME—CC

144	43.6-45.6
170 and 200	49.4-51.4
260	53.0-56.0
289	52.6-55.6

VALVE MECHANISM

VALVE CLEARANCE*

144, 170 and 200	0.066-0.216
260 and 289	0.082-0.152

*Clearance specified is obtained at the valve stem tip with the hydraulic valve lifter collapsed.

VALVE MECHANISM (Continued)

VALVE STEM DIAMETER	
Standard	
INTAKE	
All Except 289	0.3100-0.3107
289	0.3416-0.3423
EXHAUST	
All Except 289	0.3090-0.3097
289	0.3406-0.3413
0.003 Oversize	
INTAKE	
All Except 289	0.3130-0.3137
289	0.3446-0.3453
EXHAUST	
All Except 289	0.3120-0.3127
289	0.3436-0.3443
0.015 Oversize	
INTAKE	
All Except 289	0.3250-0.3257
289	0.3566-0.3573
EXHAUST	
All Except 289	0.3240-0.3247
289	0.3556-0.3563
0.030 Oversize	
INTAKE	
All Except 289	0.3400-0.3407
289	0.3716-0.3723
EXHAUST	
All Except 289	0.3390-0.3397
289	0.3706-0.3713
VALVE FACE ANGLE	
All Engines	44°
VALVE STEM TO VALVE GUIDE CLEARANCE	
Intake	
All Except 289	0.0008-0.0025—Wear Limit 0.0045
289	0.0010-0.0027—Wear Limit 0.0045
Exhaust	
All Except 289	0.0018-0.0035—Wear Limit 0.0055
289	0.0020-0.0037—Wear Limit 0.0055
VALVE HEAD DIAMETER	
Intake	
144	1.462-1.472
170 and 200	1.522-1.537
260	1.582-1.597
289	1.662-1.677
Exhaust	
144, 170 and 200	1.261-1.276
260	1.381-1.396
289	1.442-1.457
VALVE FACE RUNOUT	
Intake and Exhaust	
144, 170 and 200	0.0015
260 and 289	0.0020
VALVE SPRING FREE LENGTH—Approximate	
170	2.00
144 and 200	1.79
260	2.15
289	2.09
VALVE SPRING OUT OF SQUARE—Maximum	
All Engines	0.0625
VALVE SPRING PRESSURE—Lbs. @ Specified Length	
144 and 200	51-57 @ 1.590
	Wear Limit 46 @ 1.590
	142-158 @ 1.222
	Wear Limit 128 @ 1.222
170	47.75-56.25 @ 1.585
	Wear Limit 43 @ 1.585
	112-122 @ 1.222
	Wear Limit 101 @ 1.222
260	57-63 @ 1.770
	Wear Limit 52 @ 1.770
	161-178 @ 1.380
	Wear Limit 145 @ 1.380
289	71-79 @ 1.780
	Wear Limit 64 @ 1.780
	161-177 @ 1.390
	Wear Limit 145 @ 1.390

VALVE MECHANISM (Continued)

VALVE SPRING ASSEMBLED HEIGHT	
144, 170 and 200	$1\frac{9}{16}$-$1\frac{39}{64}$
260 and 289	$1\frac{3}{4}$-$1\frac{25}{32}$
VALVE PUSH ROD MAXIMUM RUNOUT	
260 and 289	0.015
Other Engines	0.025
VALVE TAPPET DIAMETER—Standard	
All Engines	0.8740-0.8745
VALVE TAPPET TO TAPPET BORE CLEARANCE	
All Engines	0.0005-0.0020—Wear Limit 0.005
HYDRAULIC VALVE LIFTER LEAK DOWN RATE	
All Engines	10-100 Seconds
ROCKER ARM TO ROCKER ARM SHAFT CLEARANCE	
144, 170 and 200	0.002-0.004—Wear Limit 0.006
ROCKER ARM SHAFT O.D.	
144, 170 and 200	0.780-0.781
ROCKER ARM BORE DIAMETER	
144, 170 and 200	0.783-0.784

CAMSHAFT AND TIMING CHAIN

CAMSHAFT JOURNAL DIAMETER—Standard	
144, 170 and 200	1.8095-1.8105
260 and 289 #1	2.0805-2.0815
260 and 289 #2	2.0655-2.0665
260 and 289 #3	2.0505-2.0515
260 and 289 #4	2.0355-2.0365
260 and 289 #5	2.0205-2.0215
CAMSHAFT JOURNAL TO BEARING CLEARANCE	
All Engines	0.001-0.003—Wear Limit 0.006
CAMSHAFT JOURNAL MAXIMUM OUT-OF-ROUND	
All Engines	0.0005
TIMING CHAIN MAXIMUM DEFLECTION	
All Engines	0.5
CAMSHAFT LOBE LIFT	
Intake and Exhaust	
144, 170 and 200	0.232—Wear Limit 0.227
260	0.2375—Wear Limit 0.2325
289	0.2303—Wear Limit 0.2253
CAMSHAFT END PLAY	
All Engines	0.001-0.007—Wear Limit 0.012

CAMSHAFT BEARINGS

INSIDE DIAMETER	
144, 170 and 200	1.8115-1.8125
No. 1 bearing is installed with the front edge 0.115 to 0.125 inch toward the rear from the front face of the cylinder block on all engines.	
260 and 289 #1	2.0825-2.0835
260 and 289 #2	2.0675-2.0685
260 and 289 #3	2.0525-2.0535
260 and 289 #4	2.0375-2.0385
260 and 289 #5	2.0225-2.0235
No. 1 bearing is installed with the front edge 0.005 to 0.020 inch toward the rear from the front face of the cylinder block on all engines.	

CRANKSHAFT

MAIN BEARING JOURNAL DIAMETER	
Standard	
All Engines Coded Red	2.2486-2.2490
Coded Blue	2.2482-2.2486
MAIN BEARING JOURNAL RUNOUT—Maximum	
144, 170 and 200	0.0025—Wear Limit 0.0035
260 and 289	0.002—Wear Limit 0.003
CONNECTING ROD AND MAIN BEARING JOURNALS MAXIMUM OUT-OF-ROUND	
All Engines	0.0004

CRANKSHAFT (Continued)

CONNECTING ROD AND MAIN BEARING JOURNALS MAXIMUM TAPER	
All Engines	0.0003 per inch
THRUST BEARING JOURNAL LENGTH	
144, 170 and 200	1.275-1.277
260 and 289	1.137-1.139
MAIN BEARING JOURNAL THRUST FACE RUNOUT	
All Engines	0.001
CONNECTING ROD JOURNAL DIAMETER	
144, 170 and 200 Coded Red	2.1236-2.1240
Coded Blue	2.1232-2.1236
260 and 289 Coded Red	2.1232-2.1236
Coded Blue	2.1228-2.1232
CRANKSHAFT FREE END PLAY	
All Engines	0.004-0.008—Wear Limit 0.012
ASSEMBLED FLYWHEEL CLUTCH FACE MAXIMUM RUNOUT	
All Engines	0.010
ASSEMBLED FLYWHEEL O.D. MAXIMUM RUNOUT	
Standard Transmission	
All Engines Except 200	0.007
Automatic Transmission	
All Engines	0.020

MAIN BEARINGS

JOURNAL CLEARANCE	
144, 170 and 200	0.0007-0.0026
260 and 289	0.0007-0.0030
BEARING WALL THICKNESS FOR STANDARD AND UNDERSIZE JOURNAL	
144, 170 and 200 Coded Red	0.0754-0.0759
Coded Blue	0.0758-0.0763
0.002 U.S.	0.0768-0.0773
260 and 289 Coded Red	0.0955-0.0958
Coded Blue	0.0959-0.0962
0.002 U.S.	0.0969-0.0972

CONNECTING ROD

PIN BORE STANDARD DIAMETER	
Standard	
All Engines	0.9107-0.9112
BEARING BORE DIAMETER	
All Engines Coded Red	2.2390-2.2394
Coded Blue	2.2394-2.2398
BEARING BORE MAXIMUM OUT-OF-ROUND AND TAPER	
144, 170 and 200	0.0002
260 and 289	0.0004
CONNECTING ROD LENGTH—Center to Center	
144	4.854-4.856
170 and 200	4.714-4.716
260 and 289	5.154-5.156
CONNECTING ROD*	
Twist Maximum Total Difference	
All Engines	0.012
Bend Maximum Total Difference	
All Engines	0.004
*Piston pin bore and crankshaft bearing bore must be parallel and in the same vertical plane within the specified total difference at ends of 8-inch long bar measured 4-inches on each side of rod.	
CONNECTING ROD ASSEMBLY—Assembled to Crankshaft	
Side Clearance	
144, 170 and 200	0.004-0.008—Wear Limit 0.014
260 and 289	0.006-0.016—Wear Limit 0.019

CONNECTING ROD BEARINGS

BEARING TO CRANKSHAFT CLEARANCE	
144, 170 and 200	0.0006-0.0026
260 and 289	0.0009-0.0029

CONNECTING ROD BEARINGS (Continued)

BEARING WALL THICKNESS FOR STANDARD AND UNDERSIZE JOURNAL	
All Engines Coded Red	0.0569-0.0574
Coded Blue	0.0573-0.0578
0.002 U.S.	0.0583-0.0588

PISTON

PISTON DIAMETER	
Color Coded Red	
144 and 170	3.4976-3.4982
200	3.6784-3.6778
260	3.7976-3.7982
289	3.9984-3.9990
Color Coded Blue	
144 and 170	3.4988-3.4994
200	3.6796-3.6790
260	3.7988-3.7994
289	3.9996-4.0002
PISTON TO BORE CLEARANCE—AT RIGHT ANGLE TO PIN CENTERLINE	
144 and 170	0.0018-0.0036—Wear Limit 0.006
200	0.0016-0.0034—Wear Limit 0.006
260	0.0021-0.0039—Wear Limit 0.006
289	0.0020-0.0038—Wear Limit 0.006
PISTON PIN BORE DIAMETER	
All Engines	0.9124-0.9127
RING GROOVE WIDTH	
Upper Compression Ring	
144, 170 and 200	0.0805-0.0815
260 and 289	0.0800-0.0810
Lower Compression Ring	
144, 170 and 200	0.0805-0.0815
260 and 289	0.0950-0.0960
Oil Ring	
All Engines	0.1880-0.1890

PISTON PIN

PISTON PIN DIAMETER	
Standard	
144, 170 and 200	0.9120-0.9123
260 and 289	0.9118-0.9124
PISTON PIN LENGTH	
All Engines	3.010-3.030
PISTON PIN TO PISTON CLEARANCE—Loose	
260 and 289	0.0003-0.0005—Wear Limit 0.0008
Other Engines	0.0001-0.0003—Wear Limit 0.0008

PISTON RINGS

RING WIDTH	
Compression Ring	
UPPER	
All Engines	0.0774-0.0781
LOWER	
144, 170 and 200	0.0770-0.0780
260 and 289	0.0930-0.0940
SIDE CLEARANCE	
Compression Ring	
UPPER	
All Engines	0.0019-0.0036—Wear Limit 0.006
LOWER	
144, 170 and 200	0.0020-0.0040—Wear Limit 0.006
260 and 289	0.0010-0.0040—Wear Limit 0.006
Oil Ring	
All Engines	Snug
RING GAP WIDTH	
Compression Ring—Standard Bore—Upper and Lower	
144, 170 and 200	0.010-0.031
260	0.010-0.032
289	0.015-0.039
Oil Ring*—Standard Bore	
144, 170 and 200	0.015-0.066
260	0.015-0.067
289	0.015-0.069
*Steel Rail	

CYLINDER BLOCK

CYLINDER BORE DIAMETER—Standard Spreads for 8 Grades
144 and 170 .... 3.5000-3.5024
200 .... 3.6800-3.6824
260 .... 3.8003-3.8027
289 .... 4.0010-4.0034

CYLINDER BORE MAXIMUM OUT-OF-ROUND
All Engines .... 0.001—Wear Limit 0.005

CYLINDER BORE TAPER
All Engines .... 0.001—Wear Limit 0.010

HEAD GASKET SURFACE FLATNESS
144, 170 and 200 ..... 0.003 inch in any 6 inches or 0.007 inch overall
260 and 289 .... 0.003 inch in any 6 inches or 0.006 inch overall

MAIN BEARING BORE DIAMETER
144, 170 and 200 Coded Red 2.4012-2.4016
Coded Blue 2.4016-2.4020
260 and 289 Coded Red 2.4412-2.4416
Coded Blue 2.4416-2.4420

OIL PUMP—Rotor Type

RELIEF VALVE SPRING TENSION—Lbs. @ Specified Length
144, 170 and 200 .... 8.6-9.5 @ 1.078
260 and 289 .... 11.15-11.75 @ 1.704

RELIEF VALVE CLEARANCE
All Engines 0.0015-0.0029

DRIVE SHAFT TO HOUSING BEARING CLEARANCE
All Engines 0.0015-0.0029

ROTOR ASSEMBLY END CLEARANCE—Pump Assembled
All Engines 0.0011-0.0041

OUTER RACE TO HOUSING—Radial Clearance
All Engines 0.006-0.012

TORQUE LIMITS—Ft-Lbs

MAIN BEARING CAP BOLTS—Oiled Threads
All Engines 60-70

CYLINDER HEAD BOLTS—Oiled Threads
144, 170 and 200 70-75
260 and 289 65-70

OIL PAN TO CYLINDER BLOCK
144, 170 and 200 7-9
260 and 289 ¼-20 Bolt 7-9
⁵⁄₁₆-18 Bolt 9-11

MANIFOLDS TO CYLINDER HEAD
Intake
260 and 289 12-15
Exhaust
All Engines 13-18

TORQUE LIMITS—Ft-Lbs (Continued)

FLYWHEEL TO CRANKSHAFT
All Engines 75-85

OIL PUMP TO CYLINDER BLOCK
144, 170 and 200 12-15
260 and 289 23-28

OIL PUMP COVER PLATE
All Engines 6-9

OIL FILTER ADAPTER TO CYLINDER BLOCK
144, 170 and 200 10-15
260 and 289 60-100

OIL FILTER TO ADAPTER OR CYLINDER BLOCK
All Engines ... With grease on the gasket surface, hand tighten until gasket contacts adapter face. Then tighten ½ turn more.

CYLINDER FRONT COVER
144, 170 and 200 7-9
260 and 289 12-15

WATER OUTLET HOUSING
All Engines 12-15

OIL PAN DRAIN PLUG
All Engines 15-20

CAMSHAFT THRUST PLATE TO CYLINDER BLOCK
144, 170 and 200 12-15
260 and 289 6-9

WATER PUMP TO CYLINDER BLOCK OR FRONT COVER
All Engines 12-15

CAMSHAFT SPROCKET TO CAMSHAFT
144, 170 and 200 35-45
260 and 289 30-35

DAMPER OR PULLEY TO CRANKSHAFT
144, 170 and 200 85-100
260 and 289 70-90

CONNECTING ROD NUTS
144, 170 and 200 19-24
260 and 289 40-45

VALVE ROCKER ARM COVER
All Engines 3-5

VALVE ROCKER SHAFT SUPPORT TO CYLINDER HEAD
144, 170 and 200 30-35

VALVE ROCKER ARM ADJUSTING NUT
260 and 289 .... 4.5-15

OIL INLET TUBE TO OIL PUMP
All Engines 12-15

FUEL PUMP TO CYLINDER BLOCK OR CYLINDER FRONT COVER
All Engines 12-15

TORQUE LIMITS FOR VARIOUS SIZE BOLTS

CAUTION: If any of the torque limits listed in this table disagree with any of those listed in the preceding table, the limits listed in the preceding tables prevail.

Size (Inches)	¼-20	¼-28	⁵⁄₁₆-18	⁵⁄₁₆-24	⅜-16	⅜-24
Torque (Ft-lbs)	6-9	6-9	12-15	15-18	23-28	30-35
Size (Inches)	⁷⁄₁₆-14	⁷⁄₁₆-20	½-13	½-20	⁹⁄₁₆-18	⅝-18
Torque (Ft-lbs)	45-50	50-60	60-70	70-80	85-95	130-145

IGNITION SYSTEM — GROUP 9

PART 9-1 GENERAL IGNITION SERVICE

1 DIAGNOSIS AND TESTING

GENERAL INFORMATION

The ignition system consists of a primary (low voltage) and a secondary (high voltage) circuit (Fig. 1).

The primary circuit consists of the:

1. Battery.
2. Ignition switch.
3. Primary circuit resistance wire.
4. Primary windings of the ignition coil.
5. Breaker points.
6. Condenser.

The secondary circuit consists of the:

1. Secondary windings of the ignition coil.
2. Distributor rotor.
3. Distributor cap.
4. High tension wires.
5. Spark plugs.

When the breaker points are closed, the primary or low voltage current flows from the battery through the ignition switch to the primary windings in the coil, then to ground through the closed breaker points. When the breaker points open, the magnetic field built up in the primary windings of the coil moves through the secondary windings of the coil producing high voltage current. **High voltage current is produced each time the breaker points open.** The high voltage flows through the coil high tension lead to the distributor cap where the rotor distributes it to one of the spark plug terminals in the distributor cap. This process is repeated for every power stroke of the engine.

TROUBLE ISOLATION

Ignition system troubles are caused by a failure in the primary and/or the secondary circuit or incorrect ignition timing. If an engine trouble has been traced to the ignition system from the "Engine Trouble Diagnosis Guide", the trouble can be found by performing an ignition system test on a scope or by further isolating the trouble to the primary or secondary circuit as follows:

1. Remove the coil high tension lead from the distributor cap.

2. Hold the high tension lead approximately 3/16 inch from the cylinder head.

3. With the ignition switch on, crank the engine and check for a spark.

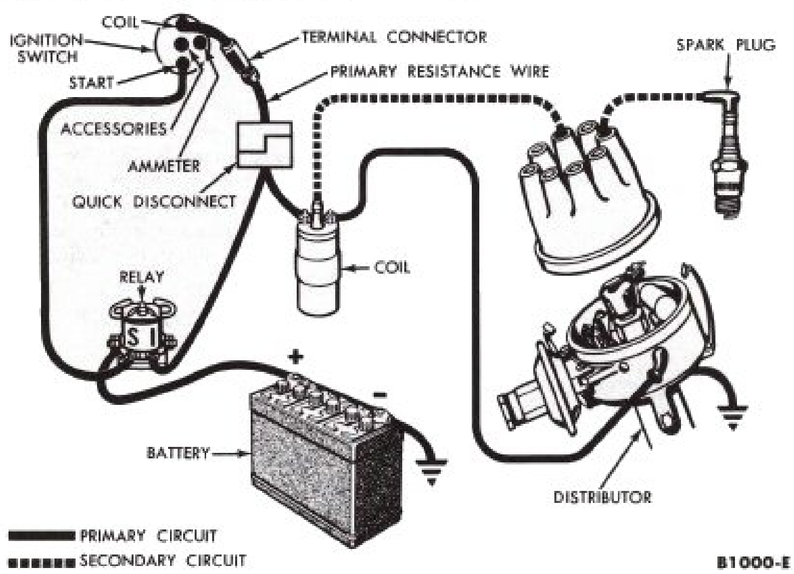


FIG. 1—Typical Ignition Circuit

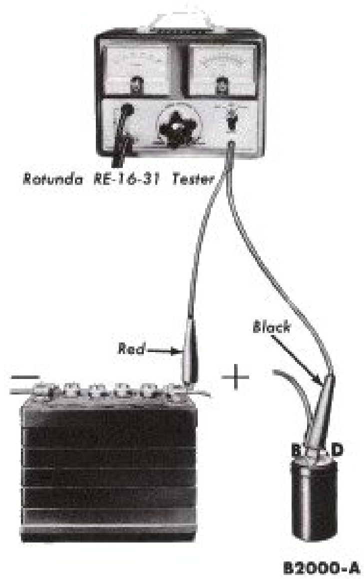


FIG. 2—Battery to Coil Test—Rotunda Tester

If the spark is good, the trouble lies in the secondary circuit from the distributor to the spark plugs.

If there is no spark or a weak spark, the trouble is in the primary circuit, coil to distributor high tension lead, or the coil.

PRIMARY CIRCUIT

A breakdown or energy loss in the primary circuit can be caused by:

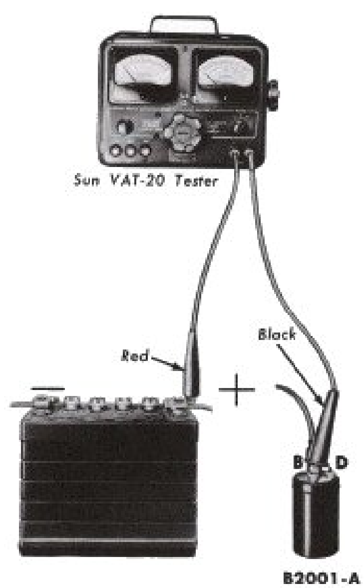


FIG. 3—Battery to Coil Test—Sun Tester

1. Defective primary wiring.
2. Burned or improperly adjusted breaker points.
3. A defective coil.
4. A defective condenser.

SECONDARY CIRCUIT

A breakdown or energy loss in the secondary circuit can be caused by:

1. Fouled or improperly adjusted spark plugs.
2. Defective high tension wiring.
3. High tension leakage across the coil, distributor cap, or rotor.

PRIMARY CIRCUIT TESTS

A complete test of the primary circuit consists of checking the circuit from the battery to the coil, the circuit from the coil to ground, and the starting ignition circuit.

Excessive voltage drop in the primary circuit will reduce the secondary output of the ignition coil, resulting in hard starting and poor performance.

BATTERY TO COIL TEST

Procedure

1. Connect the voltmeter leads as shown in Figs. 2 and 3.
2. Install a jumper wire from the distributor terminal of the coil to a good ground on the distributor housing.
3. Turn the lights and accessories off.
4. Turn the ignition switch on.

Results. If the voltmeter reading is 6.9 volts or less, the primary circuit from the battery to the coil is satisfactory.

If the voltmeter reading is greater than 6.9 volts, check the following:

1. The battery and cables for loose connections or corrosion.
2. The primary wiring for worn insulation, broken strands, and loose or corroded terminals.
3. The resistance wire for defects.
4. The relay to ignition switch for defects.

IGNITION SWITCH TEST

Procedure

1. Connect the voltmeter leads as shown in Figs. 4 and 5.
2. Install a jumper wire from the distributor terminal of the coil to a good ground on the distributor body.
3. Turn all of the accessories and lights off.
4. Turn the ignition switch on.

Results. If the voltmeter reading is 0.3 volt or less, the ignition switch

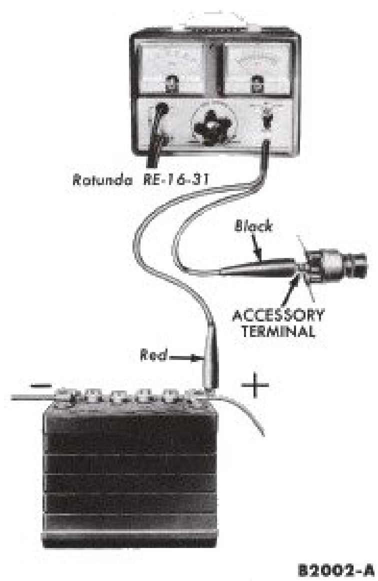


FIG. 4—Ignition Switch Test—Rotunda Tester

and the relay to switch wire are satisfactory.

If the voltmeter reading is greater than 0.3 volt, either the ignition switch and/or the wire are defective.

RESISTANCE WIRE TEST

Procedure

1. Connect the voltmeter leads as shown in Figs. 6 and 7.
2. Install a jumper wire from the

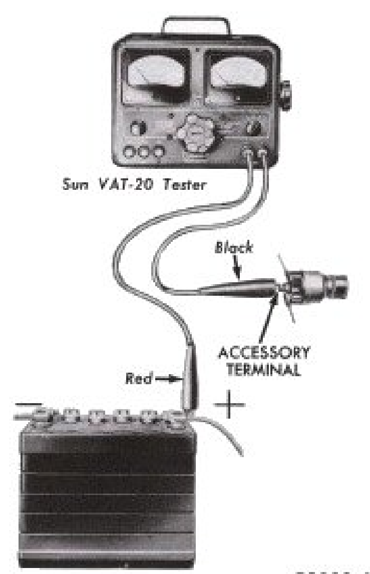


FIG. 5—Ignition Switch Test—Sun Tester

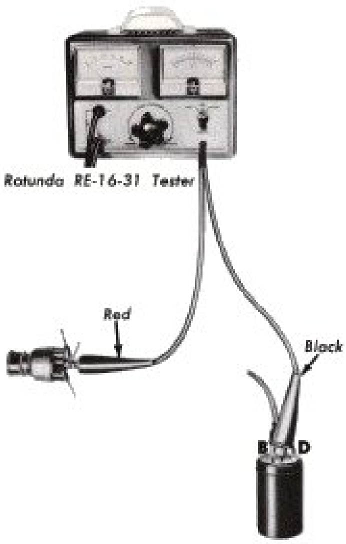


FIG. 6—Resistance Wire Test—Rotunda Tester

distributor terminal of the coil to a good ground on the distributor housing.

3. Turn all of the accessories and lights off.

4. Turn the ignition switch on.

Results. If the voltmeter reading is 6.6 volts or less, the resistance wire is satisfactory.

If the voltmeter reading is greater than 6.6 volts, replace the resistance wire.

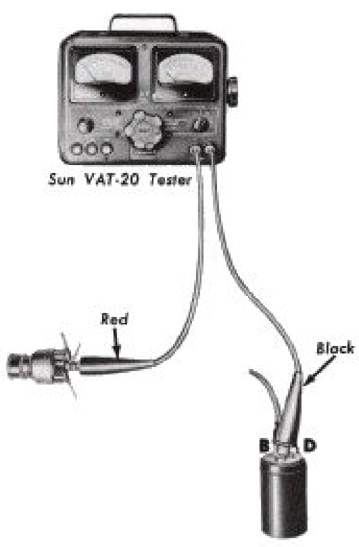


FIG. 7—Resistance Wire Test—Sun Tester

STARTING IGNITION CIRCUIT TEST

Procedure

1. Connect the voltmeter leads as shown in Figs. 8 and 9.

2. Disconnect and ground the coil to distributor high tension lead at the distributor.

3. Using a remote starter, crank the engine while observing the voltage drop.

Results. If the voltage drop is 0.1 volt or less, the starting ignition circuit is satisfactory.

If the voltage drop is greater than 0.1 volt, clean and tighten the terminals in the circuit or replace the wiring as necessary.

COIL TO GROUND TEST

Procedure

1. Connect the voltmeter leads as shown in Figs. 10 and 11.

2. Close the breaker points.

3. Turn all lights and accessories off.

4. Turn the ignition switch on.

Results. If the voltmeter reading is 0.1 volt or less, the primary circuit from coil to ground is satisfactory.

If the voltmeter reading is greater than 0.1 volt, test the voltage drop of each of the following:

1. Coil to distributor primary wire.

2. The movable breaker point and the breaker plate.

3. The breaker plate and the distributor housing.

4. The distributor housing and engine ground.

BREAKER POINTS

The breaker point assembly consists of the stationary point bracket assembly, breaker arm and the primary wire terminal.

Breaker points should be inspected, cleaned and adjusted as necessary. Breaker points can be cleaned with chloroform and a stiff bristle brush. Replace the breaker point assembly if the contacts are badly burned or excessive metal transfer between the points is evident (Fig. 12). Metal transfer is considered excessive when it equals or exceeds the gap setting.

COIL

The coil should be tested following the instructions under "Ignition System Tests."

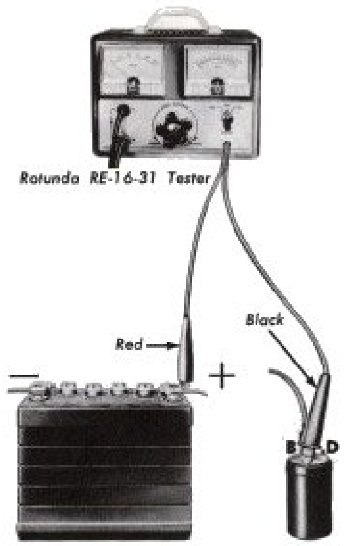


FIG. 8—Starting Ignition Circuit Test—Rotunda Tester

CONDENSER

The condenser should be tested following the instructions under "Ignition System Tests."

SECONDARY CIRCUIT TESTS

PRELIMINARY CHECKS

1. Remove the coil to distributor high tension lead and the spark plug wires from the distributor cap and

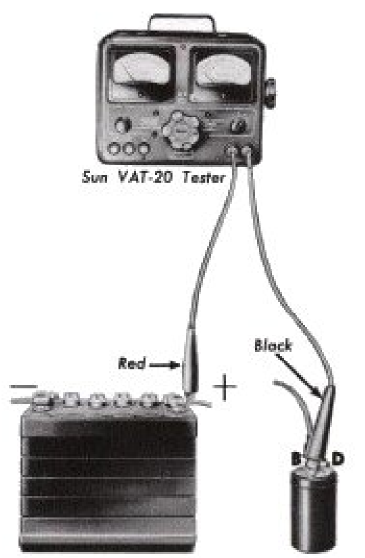


FIG. 9—Starting Ignition Circuit Test—Sun Tester

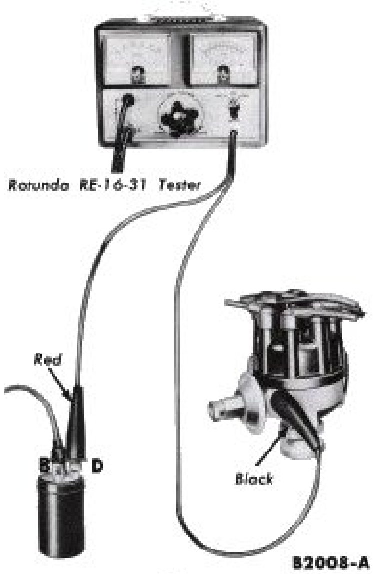
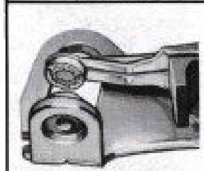


FIG. 10—Coil to Ground Test—Rotunda Tester

CONDITION	CAUSED BY
 BURNED	Any discoloration other than a frosted slate grey shall be considered as burned points.
 EXCESSIVE METAL TRANSFER OR PITTING	Incorrect alignment. Incorrect voltage regulator setting. Radio condenser installed to the distributor side of the coil. Ignition condenser of improper capacity. Extended operation of the engine at speeds other than normal.

B1443-B

FIG. 12—Breaker Point Inspection

from the spark plugs. Inspect the terminals for looseness and corrosion. Inspect the wires for breaks and cracked insulation. Replace all defective wiring.

2. Clean the inside of the distributor cap, and inspect it for cracks, burned contacts, or permanent carbon tracks. Remove dirt or corrosion from the sockets. Replace the cap if it is defective.

3. Inspect the rotor for cracks or other defects. Replace the rotor if it is defective.

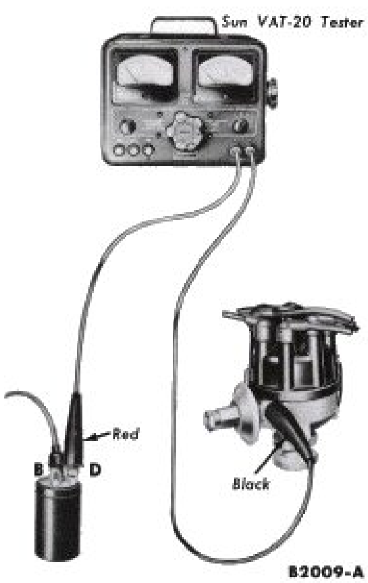


FIG. 11—Coil to Ground Test—Sun Tester

SECONDARY (HIGH TENSION) WIRES

The secondary wires include the wires connecting the distributor cap to the spark plugs and the wire connecting the center terminal of the distributor cap to the center terminal of the ignition coil.

These wires are the radio resistance type which filter out the high frequency electrical impulses that are the source of ignition noise interference. The resistance of each wire should not exceed 24,500 ohms. **When checking the resistance of the wires or setting ignition timing, do not puncture the wires with a probe. The probe may cause a separation in the conductor.**

At regular intervals, clean and inspect the wires for cracked insulation and loose terminals. Repair or replace the wires as required. A spark plug wire set is available for service.

When removing the wires from the spark plugs, grasp the moulded cap only. Do not pull on the wire because the wire connection inside the cap may become separated or the weather seal may be damaged.

Spark Intensity

1. Disconnect a spark plug wire. **Check the spark intensity of one wire at a time.**

2. Install a terminal adapter in the terminal of the wire to be checked. Hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine, using a remote starter switch. The spark should jump the gap regularly.

3. If the spark intensity of all wires is satisfactory, the coil, condenser, rotor, distributor cap, and the secondary wires are probably satisfactory.

If the spark is good at only some wires, perform a high resistance test of the faulty leads.

If the spark is equal at all wires, but weak or intermittent, make a high resistance check of the coil, distributor cap, and the coil to distributor high tension wire.

SPARK PLUGS

Clean, inspect and gap the plugs following the instructions in Sections 2 and 3. After the proper gap is obtained, check the plugs on a testing machine. Compare the sparking efficiency of the cleaned and gapped plug with a new plug. Replace the plug if it fails to meet 70% of the new plug's performance.

Test the plugs for compression leakage at the insulator seal. Apply a coating of oil to the shoulder of the plug where the insulator projects through the shell, and to the top of the plug, where the center electrode and terminal project from the insulator. Place the spark plug under pressure with the tester's high tension wire removed from the spark plug. Leakage is indicated by air bubbling through the oil. If the test indicates compression leakage, replace the plug. If the plug is satisfactory, wipe it clean.

IGNITION TIMING

Incorrect ignition timing can be caused by:

1. Timing incorrectly adjusted.
2. Distributor bushing and/or shaft worn, or a bent distributor shaft.

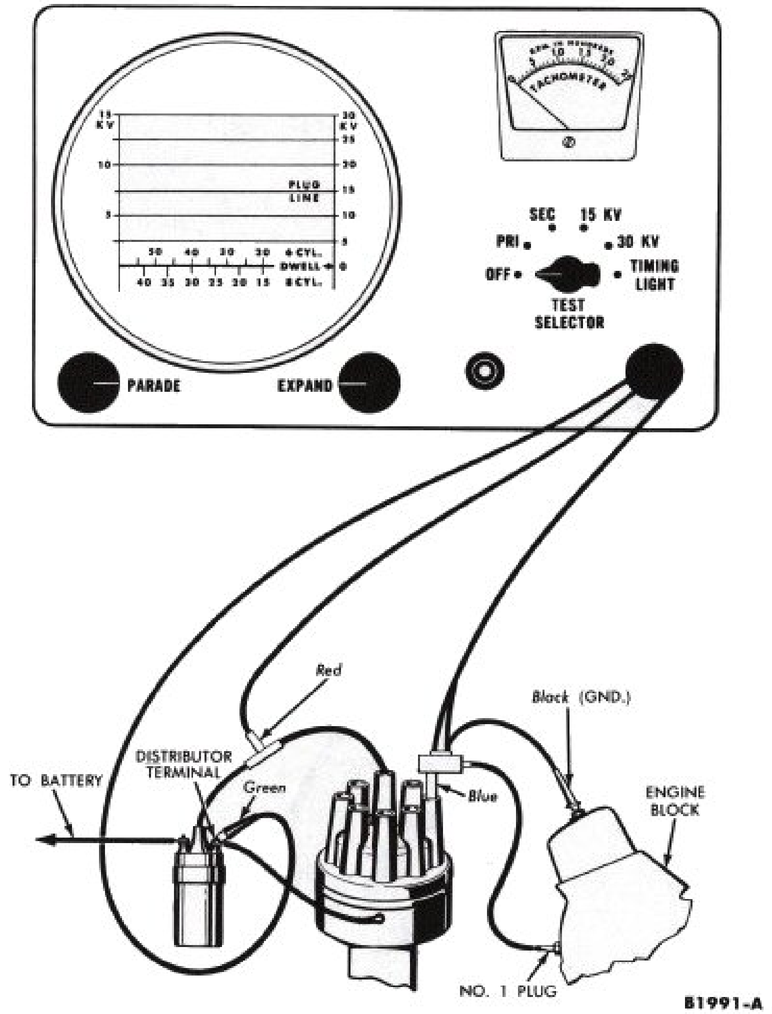


FIG. 13—Rotunda RE-235 Test Connections

3. Defective vacuum advance system.

4. Defective centrifugal advance system (dual advance distributor).

IGNITION SYSTEM TESTS—ROTUNDA TESTERS

TEST CONNECTIONS—RE-235, RE-651, AND RE-881

The test connections for the RE-235 tester are shown in Fig. 13, the test connections for the RE-651 tester are shown in Fig. 14, and the test connections for the RE-881 tester are shown in Fig. 15.

1. With the tester turned off, plug the power plug into a proper AC outlet.

2. Connect the green lead to the distributor terminal of the coil.

3. Remove the No. 1 plug wire from the distributor cap, place the blue pickup in the cap and place the plug wire in the pickup.

4. Now connect the black lead to a good ground.

5. Clip the red pickup over the coil-to-distributor high tension wire.

6. If the engine timing is to be checked, plug the timing light into its socket.

The following steps pertain to the RE-651 and RE-881 testers only.

7. Disconnect the battery wire from the regulator and place it in the knob end of the 100 ampere shunt.

8. Place the spade terminal from the 100 ampere shunt and the yellow lead on the battery terminal of the voltage regulator.

9. Turn the ground polarity switch to the minus position. On the RE-881 tester, turn the volts switch to the 20 volt position.

POINT RESISTANCE TEST

RE-651 Tester

1. Remove and ground the high tension wire from the center of the distributor.

2. Turn the volt switch to the point resistance (PT. RES.) position. The points should be closed for this test. If the breaker points are open, the meter will read the battery voltage (0 to 40 scale).

3. "Bump" the starter with the starter switch until the voltmeter pointer decreases to the lowest reading in the black zone.

4. Depress the PT. RES. pushbutton.

5. The voltmeter pointer should read within the 12V area as shown in black on the meter dial. If not, check for incorrect breaker point spring tension or for burned or pitted points.

6. Connect the high tension wire to the distributor.

RE-881 Tester

1. Remove and ground the high tension wire from the center of the distributor.

2. "Bump" the starter with the starter switch to close the breaker points. This will be indicated by the lowest reading on the voltmeter.

The voltmeter pointer should read in the black OK PT. RES. area. If it does not, check for improper breaker point spring tension or for burned or pitted points.

3. Connect the high tension wire to the distributor.

IGNITION TIMING

Disconnect the vacuum line. If necessary, clean and mark the desired timing mark.

RE-235 Tester

1. Start the engine and allow it to warm up.

2. Operate the engine at the specified idle speed and point the timing light towards the pointer. The desired timing mark should line up with the pointer. If it does not, loosen the distributor hold down bolt(s) and rotate the distributor until the mark lines up with the pointer. Now tighten the hold down bolt(s) and check the timing.

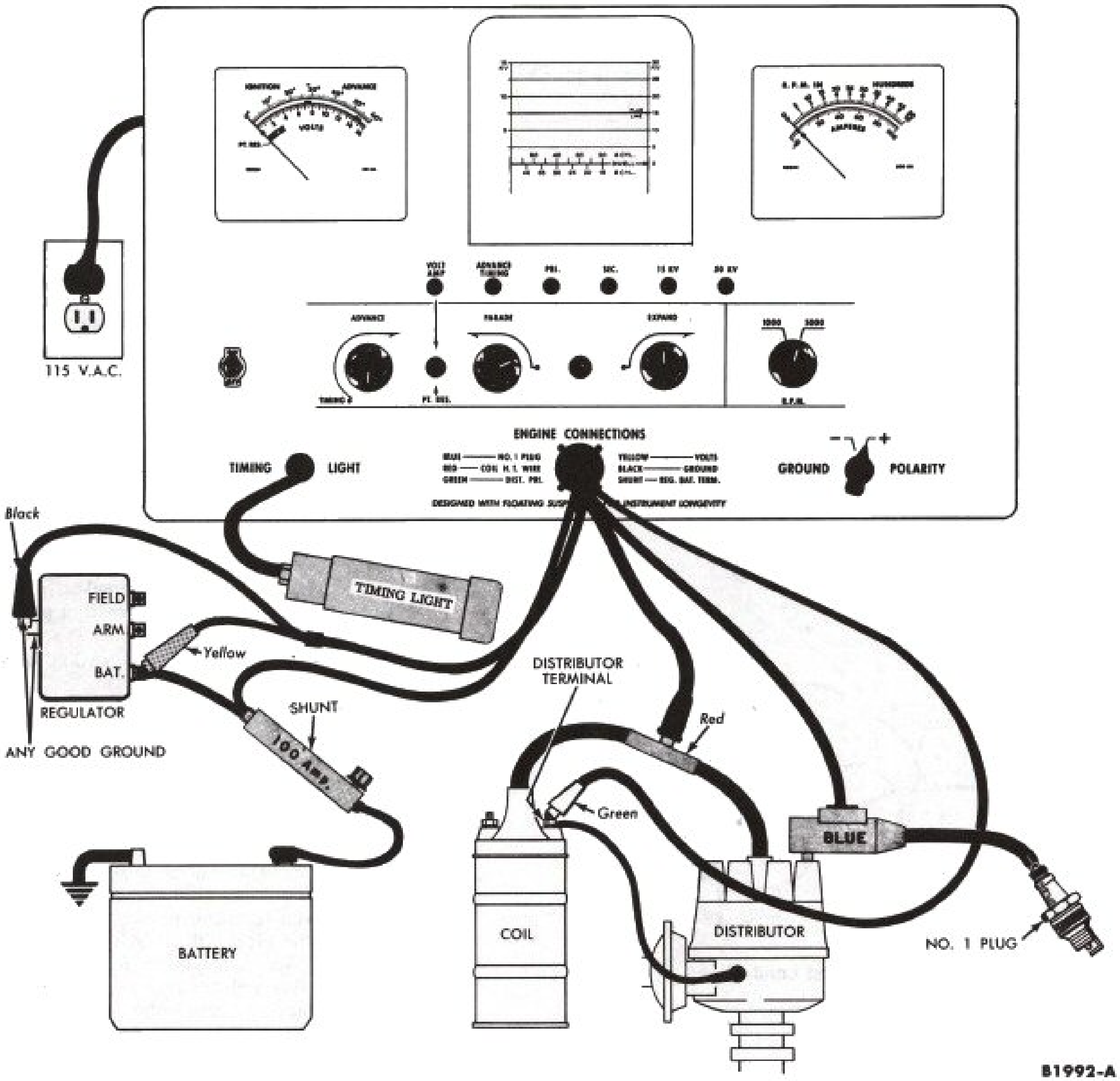


FIG. 14—Rotunda RE-651 Test Connections

RE-651 Tester

1. Turn the rpm selector to the 1000 position.
2. Depress the advance timing pushbutton.
3. Start the engine and allow it to warm up.
4. Operate the engine at the specified idle speed.
5. Turn the advance knob until the ignition advance meter reads 0°.
6. Point the timing light towards the timing pointer. The desired timing mark should line up with the pointer. If it does not, loosen the distributor hold down bolt(s) and rotate the distributor until the desired timing mark and pointer line up. Tighten the distributor hold down bolt(s) and check the timing.

RE-881 Tester. The method of testing is the same as the RE-651 tester with the exception of step 1 which should (for the RE-881) read "turn the rpm selector to the 800 position."

SUPERIMPOSED PRIMARY PATTERN

Procedure

RE-235 Tester

1. With the engine running at 1000 rpm, turn the test selector switch to the primary (PRI.) position.
2. Adjust the parade control to position the left end of the pattern at the left vertical line on the screen.
3. Adjust the expand control so that the right end of the pattern is at the right vertical line on the screen.

RE-651 Tester

1. Turn the rpm selector to the 5000 position. Start the engine and adjust it to 1000 rpm.
2. Depress the PRI. pushbutton on the console panel.

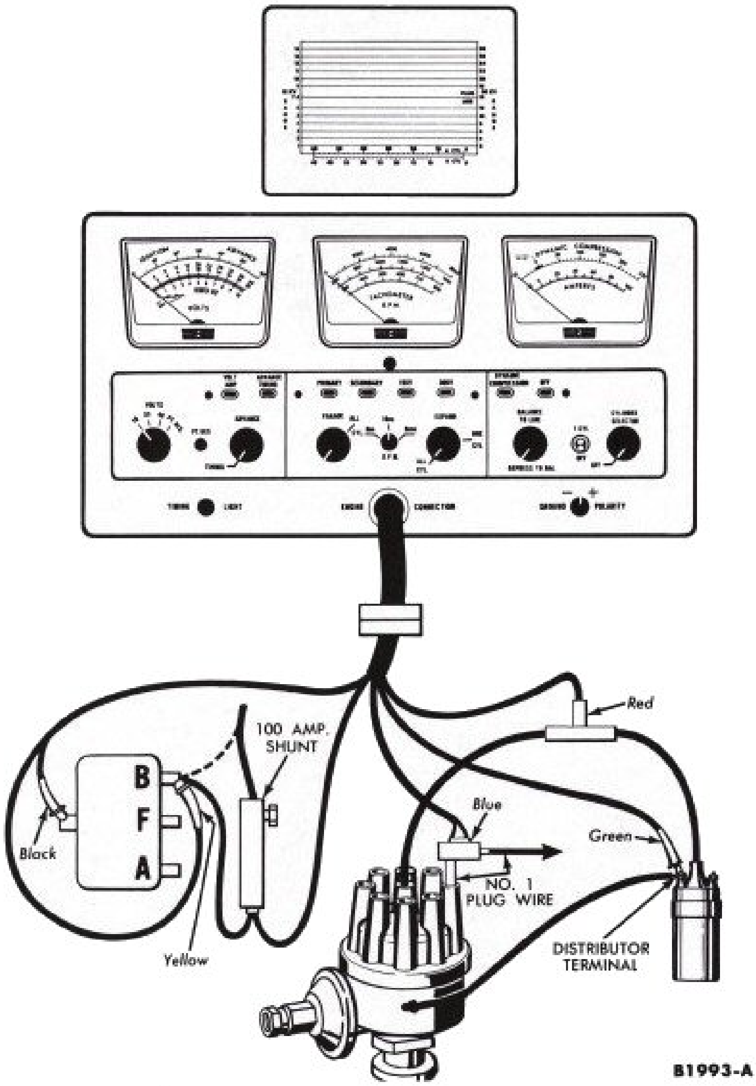


FIG. 15—Rotunda RE-881 Test Connections

3. Adjust the parade and expand controls to position the left end of the pattern at the left vertical line on the screen and the right end of the pattern at the right vertical line on the screen.

RE-881 Tester. The test procedure for the RE-881 is the same as the test procedure for the RE-651 except for the setting of the rpm selector. For the RE-881 tester, the rpm selector is turned to the 1600 position.

Results. A normal test pattern for an eight cylinder engine is shown in Fig. 16. The six cylinder test pattern would be very similar, the only difference would be the dwell value.

Point A indicates the spark plug line which is the time when the points open. At B the coil energy is used up sufficiently so that the plug no longer fires and only the energy stored in the breaker point condenser remains. This coil/condenser oscillation which is indicated in the pattern between B and C is completely used up at C, which is the points close mark. The portion of the pattern between C and D is the points close time, which is cam angle or dwell time. At D the points again open and the firing cycle repeats.

If points A and C are below the horizontal 0 line, the battery polarity is incorrect. This could be caused by a battery that is either installed incorrectly or improperly charged causing a polarity reversal.

If the firing line is not below the 0 line and there are no oscillations at point C, there is an open circuit at the coil high tension tower. This could be caused by a broken wire inside the coil tower, or a broken center contact on the distributor rotor.

If the dwell time is too short, the breaker points are incorrectly set (the larger the gap, the smaller the dwell).

If point A is at a reduced height, and the distance to B is short or nonexistent, and the oscillations at point C are reduced in height, there is a high resistance in the coil primary circuit. This could be caused by a fouled plug, defective ignition switch, or a bad wire or connection. If the scope pattern is still the same after the above ignition parts have been checked and proven satisfactory, run the 15 KV test to check for a gasket leak or a lean fuel mixture.

If point A is at a greatly reduced height and there are no oscillations at point B, the coil has a defective primary winding or the condenser has an excessive series resistance.

If there is a variation at points C and D, the cam lobes are uneven, the distributor shaft is bent, or the distributor bushings are worn.

SUPERIMPOSED SECONDARY PATTERN

Procedure

RE-235 Tester

1. With the engine running at 1000 rpm, turn the test selector switch to the secondary (SEC.) position.

2. Adjust the parade and expand controls so that the left end of the pattern is at the left vertical line on

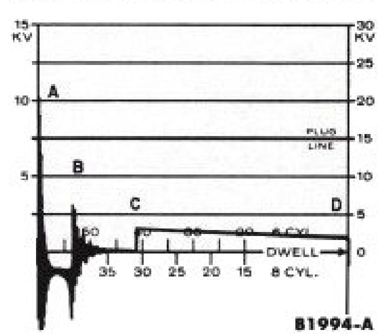


FIG. 16—Normal Superimposed Primary Pattern

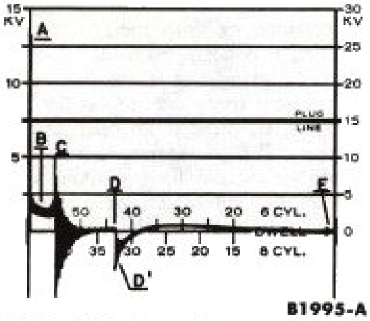


FIG. 17—Normal Superimposed Secondary Pattern

the screen and the right end of the pattern is at the right vertical line on the screen.

RE-651 and RE-881 Testers. The procedure is the same as the procedure for the primary (superimposed) except, the SEC. pushbutton is depressed instead of the PRI. pushbutton.

Results. A normal test pattern for an eight cylinder engine is shown in Fig. 17. The six cylinder test pattern would be very similar. The only difference would be the dwell value.

Point A is the points open time. The height of the pattern at point A indicates the high tension voltage required to overcome the spark plug gap resistance.

Point B is the plug firing line. Notice that this portion of the pattern is quite thick. Remember that this pattern is actually six or eight firing patterns superimposed one on top of the other. This increase in thickness of the pattern at B is caused by slight variations in the plug gap, distributor rotor gap and slight differences in the resistance of the individual spark plug circuits.

The pattern area between point C and D shows the coil/condenser oscillations to be correct. No point bounce at D indicates correct breaker point spring tension.

The few so-called damped oscillations appearing at D are normal and are caused by the surge of current through the coil primary winding when the breaker points first close.

This current levels off and decreases slightly toward the points open position at E as indicated by the slight downward slope of the curve at about the 15° mark on the cam angle scale.

To observe the coil/condenser oscillations and the damped oscillations at D¹ in greater detail, adjust the expand control so that the pattern area between point C and D¹ nearly fills the screen.

If there is erratic action at points C and D, and there is a blotch above point E, the breaker points are burned or badly pitted.

If the length of B is reduced and the pattern between C and D is not superimposed, there is a series gap in the coil high tension tower or wire.

If the line at B is sloping downward greatly (resistor plugs will cause a slight slope), there is a high resistance in the spark plug wires, distributor cap or rotor.

If point D¹ is varying erratically, the distributor is badly worn. If this variation is definite instead of erratic, the advance mechanism in the distributor is defective.

If the dwell line between points D¹ and E is not the smooth line shown, there is a loose connection in the primary circuit. Check the primary circuit for loose connections, damaged wires or a defective starter switch.

15 KV PATTERN

Procedure

RE-235 Tester. With the engine operating at 1000 rpm, turn the test selector switch to the 15 KV position. Adjust the expand and parade controls to produce the pattern shown in Fig. 18.

RE-651 Tester. With the rpm selector at the 5000 position and the engine operating at 1000 rpm, depress the 15 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 18.

RE-881 Tester. With the rpm selector at the 1600 position and the engine operating at 1000 rpm, depress the 15 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 18.

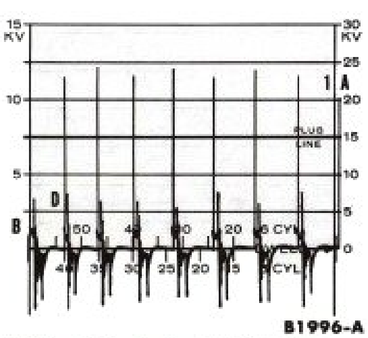


FIG. 18—Typical 15 KV Pattern

Results. A normal eight cylinder engine 15 KV pattern is shown in Fig. 18. The six cylinder pattern would have six similar images. The spark plug line (A) for the No. 1 spark plug is on the extreme right hand side of the screen. The remainder of the No. 1 firing pattern is on the left side of the screen. The remainder of the patterns are shown from left to right in engine firing order.

With the exception of the No. 1 spark plug line (which should be shorter than the others), the patterns should be similar. If one of the patterns differs from the others, adjust the expand and parade controls until that pattern fills the screen in the same manner as in the secondary test (Fig. 17).

The following list of symptoms will refer to Fig. 17.

If the points open line (A) is higher than the rest and the plug firing line (B) is sloped downward at an unusually large slope, there is excessive resistance in the high tension wire to that cylinder or in the distributor cap.

If the points open line (A) is low and the firing line (B) is long and nearly straight, the spark plug is shorted out.

If the points open line (A) is low and the firing line (B) is long and wide, the spark plug gap is out of adjustment.

If there are no oscillations at points C or D, the coil primary windings are partially shorted.

If the points open line (A) and the oscillations at point D are both displaced to the right on all cylinders, check the breaker points.

If all of the points open lines (A) are at varied heights, check the idle adjustment of the carburetor (always

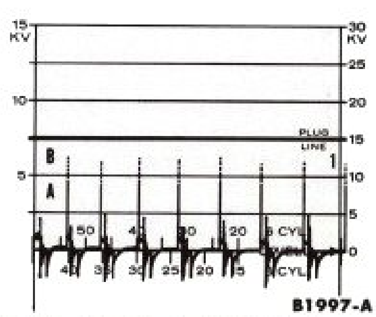


FIG. 19—Typical 30KV Pattern

adjust the idle mixture on the rich side).

30 KV PATTERN

Procedure

RE-235 Tester. With the engine running at 600 rpm, turn the test selector switch to the 30 KV position. Adjust the expand and parade controls to produce the pattern shown in Fig. 19.

RE-651 Tester. With the rpm selector at the 5000 position and the engine operating at 600 rpm, depress the 30 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 19.

RE-881 Tester. With the rpm selector at 1600 position and the engine operating at 600 rpm, depress the 30 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 19.

Results. A normal eight cylinder engine 30 KV pattern is shown in Fig. 19. The six cylinder pattern would have six similar images. The spark plug line (A) for the No. 1 spark plug is on the extreme right hand side of the screen. The remainder of the No. 1 firing pattern is on the left side of the screen. The remainder of the patterns are shown from left to right in engine firing order.

Notice the average height of the solid part of the points open line. Increase the speed of the engine and notice the height of the dotted lines. The difference is the required ignition output under load. The maximum output should be between 13.5 and 15 KV.

If the maximum for one or more of the plugs is above 15 KV, check the complete circuit(s) of the plug(s) for any trouble that would cause this resistance. If the maximum does not increase during the increase in engine speed, check for a fouled or improperly gapped spark plug or for very low compression.

Remove the high tension wire **at the distributor cap** for any plug except No. 1. Notice the change between the average points open line and the points open line of the cylinder with the high tension wire removed. This height difference is the coil reserve. The coil reserve should be at least 30% of the maximum output. If it is less than 30%, replace the coil.

Remove, but do not ground one spark plug wire at the spark plug. If a plug firing line shows up on the scope for that cylinder, check the plug wire and distributor cap for bad insulation.

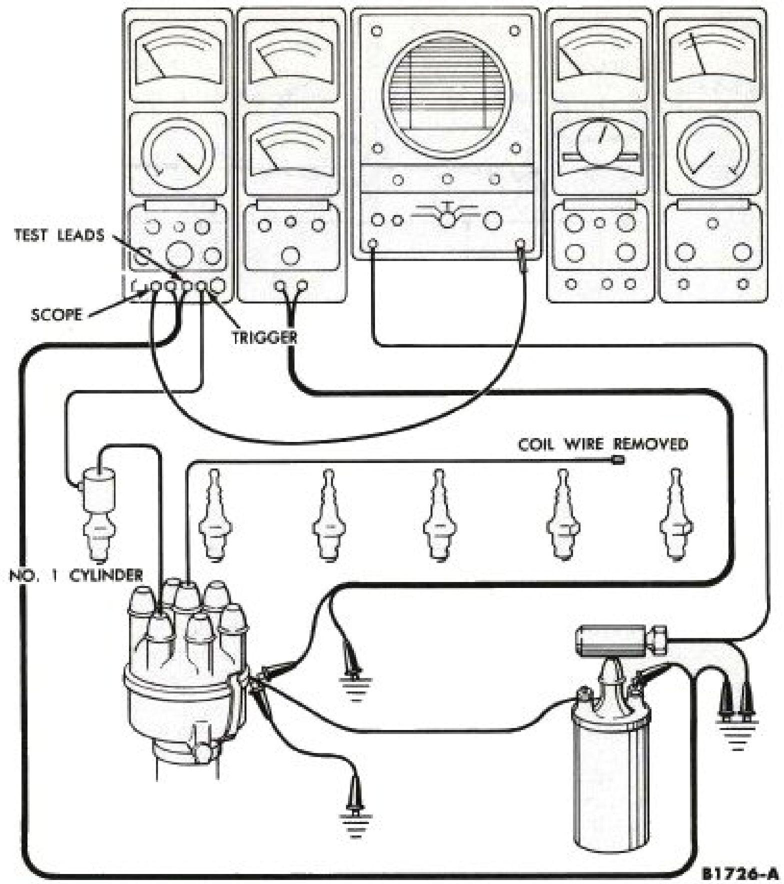


FIG. 20—Sun 900 Test Connections

IGNITION TESTING WITH A SUN 900 TESTER

TEST CONNECTIONS

Most of the ignition system can be tested by using the Sun 900 Scope Motor Tester. Make the connections as follows (Fig. 20):

1. Plug the power cord into a proper outlet.

2. Turn the AC master switch to the ON position.

3. Turn the Tach-Dwell selector switch to the calibrate (CAL.) position and adjust the dwell calibrator until the meter pointer reads on the SET line.

4. Turn the Tach-Dwell rpm switch to the 5000 position.

5. Connect the Tach-Dwell leads. Connect the red insulator lead to the primary distributor lead at the coil. Connect the black insulator lead to a good ground.

6. Connect the trigger pickup into the circuit of the first spark plug in the firing order.

7. Turn the Voltage Leakage unit control counterclockwise to the timing position.

8. Connect a jumper lead from the distributor primary to a good ground.

9. Set the Voltage Leakage switch to the 20V position.

10. Connect the Voltage Leakage test leads; the red lead is connected to the battery side of the coil and the black lead is connected to a good ground.

11. Remove the high tension wire from the coil and leave the wire disconnected.

12. Insert the scope pattern pickup into the coil tower and attach the ground clip to a good ground.

13. Set the scope ground polarity switch to the positive (+) position.

14. Turn the scope display selector to the SCOPE CHECK position and adjust the horizontal and vertical knobs until the trace appears on the

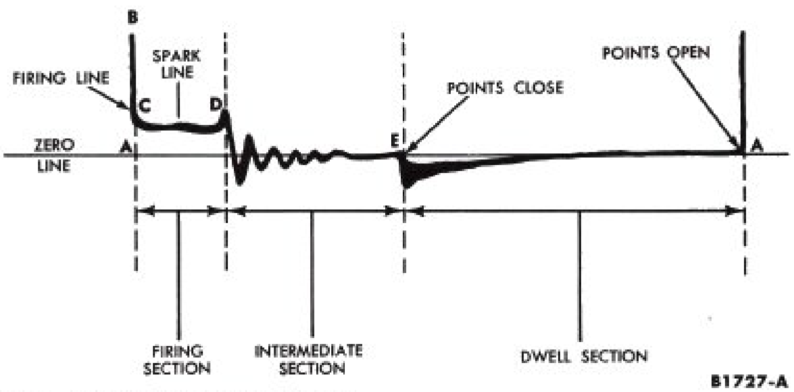


FIG. 21—Typical Scope Pattern

zero (0) line (allow about 30 seconds for warm-up before adjustment).

CRANKING VOLTAGE

1. With the tester connected, turn the ignition switch on. Make sure that the transmission is in neutral and that the parking brake is set.
2. Crank the engine, observe the speed and note the reading on the voltmeter.

If the meter reads less than the specified voltage, check for the following: weak battery, defective cables, connections, switch, starter, by-pass circuit, or ignition circuit to coil.

If the speed is uneven or slow, the engine or starting circuit is defective.

BREAKER POINTS

1. With the motor tester connected, turn the scope display selector to the individual cylinder position.
2. Remove the jumper lead from the distributor to ground.
3. Insert the coil high tension wire into the scope pattern pickup.
4. Run the engine at 1200 rpm.
5. Observe the point open and point close signals (Fig. 21). If an unusual point close signal is obtained (an unusual point close signal is one that does not have a short straight downward line followed by a series of closely grouped rapidly diminishing oscillations), check for poor point contact, misaligned points, or weak point spring tension.

If an unusual point open signal is obtained (an unusual point open signal is one that does not form a firing line that is straight up and down), check for dirty or burned points, or high series resistance.

COIL

Polarity

1. Remove the jumper lead from the distributor to ground, if it is still connected.
2. Insert the coil high tension lead into the scope pattern pickup.
3. Adjust the engine speed to 1200 rpm.
4. Turn the scope display selector to the all cylinders position, and adjust the pattern length control until all cylinders appear between the vertical lines on both sides of the screen.
5. Rotate the pattern shift control counterclockwise until the last pattern on the screen appears complete.
6. Observe the patterns, noting if they are upright or inverted (Fig. 21).

If they are inverted, check for the scope ground polarity switch in the minus (—) position, battery polarity reversed, coil improperly connected, or incorrect coil.

To check the coil for shorted or open windings and for primary or secondary resistance, calibrate the Condenser-Coil Unit as follows:

1. Turn the AC switch to ON.
2. Set the Condenser-Coil Unit selector switch at the OHMS position.
3. Set the Condenser-Coil ohms switch to the desired range.
4. Connect the test leads together.
5. Adjust the Condenser-Coil calibrator until the meter pointer reads zero on the ohms scale.
6. Disconnect the test leads.
7. Disconnect all leads from the coil.

Shorted or Open Windings

1. Calibrate the Condenser-Coil Unit (the ohm switch should be in the OHMS position).
2. Connect the test leads, one to each coil primary terminal. Observe the polarity.
3. Insert the coil pickup into the secondary tower of the coil and connect the ground lead of the pickup to a good ground.
4. Turn the Condenser-Coil Unit selector switch to the COIL TEST position and observe the wave pattern visible on the coil test scope.

Refer to Fig. 22 for checking the data obtained.

Primary Resistance

1. Calibrate the Condenser-Coil Unit (set the ohm switch to the OHMS position).
2. Connect the test leads, one to each primary terminal of the coil.
3. Observe the meter reading and compare it with specifications.

Secondary Resistance

1. With the ohm switch set at the OHMS x 1000 position, calibrate the Condenser-Coil Unit.
2. Install the coil pickup test lead in the tower of the coil.
3. Connect the ohmmeter test leads, one to either primary terminal and the other to the open (pigtail) end of the coil pickup test lead.
4. Observe the meter reading and compare it with specifications.

If the meter reading exceeds 20,000 ohms, the secondary winding is open.

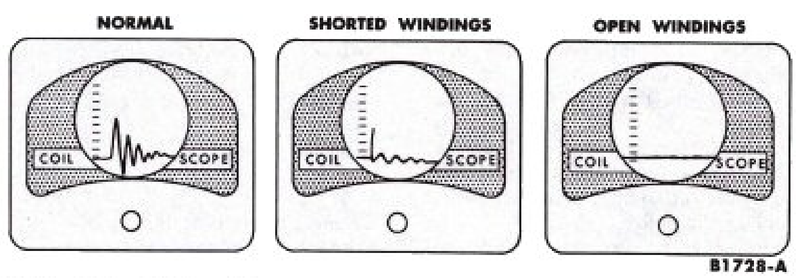


FIG. 22—Coil Test Patterns

CONDENSER

For the condenser tests, calibrate the Condenser-Coil Unit as follows:

1. Set the selector switch to the condenser position.
2. Connect the test leads together.
3. After allowing approximately one minute for the tester to warm up, adjust the calibrator until the meter pointer reads on the set line at the right end of the meter scale. **Do not change this setting during the tests.**

Resistance

1. Connect the test leads, one to the primary terminal of the distributor and the other to a ground on the distributor body.
2. With the condenser test switch in the series resistance position, the meter should read in the black bar at the right end of the scale.
3. Move the condenser pigtail. If a deflection of the meter is noted, the pigtail is making poor contact and the condenser should be replaced.

If the reading is outside the black bar, move the grounded lead to the body of the condenser. If the reading improves, the condenser is not properly grounded to the distributor housing.

Capacity

1. Turn the condenser test switch to the capacity position.
2. Read the red scale of the meter (0.5) for the microfarad capacity of the condenser being tested.
3. Refer to the specifications for the recommended condenser capacity.

If the readings are not within the specifications, replace the condenser.

Leakage

1. Turn the condenser test switch to the leakage position.
2. The meter should now read in the black bar at the left end of the scale if the condenser leakage is satisfactory.

If the meter pointer reads outside the black bar, the condenser insulation is leaking and the condenser should be replaced.

If the condenser does not meet specifications while mounted in the distributor, remove the condenser and retest it. The same procedure is followed as above. If the condenser tests bad in the distributor, but tests good when removed, there is a short or ground in the distributor primary circuit. Inspect the insulation of the distributor primary terminal and the internal circuit of the distributor.

FIRING VOLTAGE

1. Remove the jumper from the distributor to ground.
2. Insert the coil high tension lead in the scope pickup.
3. Adjust the engine speed to 1200 rpm.
4. Turn the scope display selector to the all cylinders position, and adjust the pattern length control until all of the cylinders appear between the vertical lines on the screen.
5. Rotate the pattern shift control counterclockwise until the last pattern on the screen appears complete.
6. Observe the height of each firing line, on the scope, and compare for uniformity and height (Fig. 21).

If the firing voltages are uniform, but high, check for worn spark plugs, late ignition timing, lean fuel mixture, too large a rotor gap, or a break in the coil wire.

If the firing voltages are uneven, check for worn spark plugs, uneven compression, breaks in spark plug wires, or a cocked or worn distributor cap.

AVAILABLE VOLTAGE

1. Make the same connections and adjustments as for the firing voltage test above.
2. Disconnect a spark plug wire with a pair of insulated pliers.
3. Hold the wire away from a ground and notice the upward extent of the pattern on the scope.

If the available voltage is less than 20 KV, check for excessive resistance in the primary circuit, low primary input voltage, defective coil, dwell less than specified, or defective secondary insulation.

SECONDARY INSULATION

1. Continue with the same connections and adjustments as in the last two tests.
2. Observe the downward extent of the pattern of the spark plug with the wire removed.
3. Connect the spark plug wire.
4. Perform this test on all of the cylinders (trigger cylinder may be tested in the scope check position).

If the lower extent is not at least half the size of the upper extent, check for insulation leakage in the coil, coil tower, rotor, coil wire, distributor cap, or spark plug wire.

SECONDARY RESISTANCE

1. The connections and adjustments for this test are the same as for the last three tests, except for the scope display selector switch which is now placed in the all cylinders position.
2. Observe and compare the spark line (Fig. 21) of the patterns for length, height, angle and oscillations.

If all cylinders are affected, check for high resistance in the coil tower, coil wire, rotor, or distributor cap tower; also check for an accumulation of deposits on the spark plugs, or poor contact between the rotor and distributor cap.

If one or more cylinders are affected, check for high resistance in the distributor cap tower, spark plug wires, or spark plugs.

SPARK PLUGS

To test the spark plugs on the car, connect the motor tester in the same manner as for the firing voltage test.

1. Turn the display selector switch to the all cylinders position; rotate the pattern shift control in the full clockwise position.
2. Momentarily accelerate the engine to about 2000 rpm and return to 1200 rpm.
3. Observe the rise of the firing lines during the momentary engine acceleration.

If one or more of the firing lines is higher than the others, check for wide plug gap, open spark plug resistor wire, or badly deteriorated electrodes.

If one or more of the firing lines is lower than the others, check for spark plug fouling, flashover, or cracked insulators.

DISTRIBUTOR DIAPHRAGM LEAKAGE AND FREENESS OF OPERATION—LOADOMATIC AND DUAL ADVANCE DISTRIBUTORS

These tests can be made with the distributor installed on the engine. The tests are sufficient for an engine tune-up. However, if there are indications that the spark advance is not functioning properly, remove the distributor from the engine and check it on a distributor test set following the instructions under "Distributor Spark Advance."

Check the vacuum advance mechanism for freeness of operation by manually rotating the breaker plate in the direction of rotation. **Do not rotate the plate by pushing on the condenser or the breaker point. Use a hook or other suitable instrument to rotate the plate.** The breaker plate should turn without

binding and return to its original position when released. If the breaker plate binds, remove the plate. Clean, inspect and lubricate it as described for the particular distributor.

To check the diaphragm for leakage:

1. Remove the vacuum line from the distributor. Adjust the vacuum pressure of a distributor tester to its maximum position. Hold one hand over the end of the tester's vacuum hose and note the maximum reading obtained. **Do not exceed 25 inches Hg.**

2. If the maximum reading is 25 inches Hg or less, connect the tester's vacuum line to the vacuum fitting on the diaphragm **without changing any of the adjustments.** The maximum gauge reading should not be less than it was in step 1. If it is less, the diaphragm is leaking and should be replaced.

DISTRIBUTOR BREAKER PLATE WEAR — LOADOMATIC AND DUAL ADVANCE DISTRIBUTORS

A worn breaker plate will cause the breaker point gap and contact dwell to change as engine speed and load conditions are varied. Mount the distributor in a distributor tester following the instructions in this section of the manual.

LOADOMATIC DISTRIBUTOR

There should not be more than a 3° variation in dwell between engine idle speed and 2500 rpm. If the contact dwell changes more than 3°, the bushing should be replaced.

DUAL ADVANCE DISTRIBUTOR

Adjust the test set to 0° advance, 0 inches vacuum, and 1000 rpm. Adjust the dwell angle to 26°. Apply vacuum to the distributor diaphragm and increase it very slowly while observing the indicated dwell angle. The maximum dwell angle variation should not exceed 6° when going from zero to maximum vacuum at constant rpm. If the dwell angle variation exceeds this limit, there is excessive wear at the stationary subplate pin or the diaphragm rod is bent or distorted.

DISTRIBUTOR GEAR BACKLASH — LOADOMATIC DISTRIBUTOR

The distributor gear backlash can not be accurately checked on the dual advance distributor.

1. Mount a dial indicator on the distributor so that the indicator point rests on the rotor, ⅝ inch from the center.

2. Turn the rotor as far as it will go and set the indicator on zero.

3. Turn the rotor in the opposite direction and note the reading on the dial indicator. This is the backlash.

4. The backlash should be within specifications. If the backlash is not to specifications, it indicates an incorrect number of teeth on the distributor or camshaft gear, or excessively worn gears.

DISTRIBUTOR SHAFT END PLAY

If the shaft end play is not to specifications, check the location of the gear on the shaft (loadomatic distributor), or the distributor shaft collar (dual advance distributor).

LOADOMATIC DISTRIBUTOR

The shaft end play can be checked with the distributor installed on the engine.

1. Mount a dial indicator on the distributor so that the indicator tip rests on the top of the distributor shaft.

2. Push the shaft down as far as it will go and set the dial indicator on zero.

3. Pull the distributor shaft upward as far as it will go and read the end play.

DUAL ADVANCE DISTRIBUTOR

1. Remove the distributor from the engine.

2. Place the distributor in the holding tool and clamp it in a vise.

3. Push the distributor shaft upward as far as it will go, then check the end play with a feeler gauge placed between the collar and the distributor base. The end play should be within specifications.

DISTRIBUTOR TESTS — ROTUNDA RE-1416 TESTER

MOUNTING DISTRIBUTOR

1. Clamp the distributor securely in the distributor support arm clamp so that it will not turn in its mounting.

2. Loosen the hand-operated locking screw on the side of distributor support arm and adjust the support arm column up or down by turning the crank on the knob at the top of the column until the distributor shaft or adapter shaft can be securely fastened in the driving chuck. Use the adapter shafts provided when driving distributors having short shafts.

3. Securely tighten the drive chuck to the distributor drive shaft by means of the chuck key, attached by a chain to the Syncrograph.

4. Rotate the drive chuck by hand to make sure the distributor shaft turns freely and then tighten the locking screw on the distributor support arm.

5. Connect the Syncrograph test lead to the primary wire of the distributor.

BREAKER POINT RESISTANCE

1. Turn the test selector to the POINT RES. position.

2. Revolve the chuck by hand until the distributor breaker points are closed.

3. The meter pointer on the cam angle meter should read in the OK zone at the left side of the meter scale. If the meter pointer does not fall in the OK zone, there is excessive resistance caused by a faulty contact across the distributor points, a faulty primary lead or a poorly grounded base plate. A faulty contact across the distributor points indicates improper spring tension or burned or pitted points.

INSULATION AND LEAKAGE

1. Turn the test selector to the cam angle position and revolve the chuck by hand until the distributor breaker contacts are open.

2. The cam angle meter should show a zero reading. If a zero reading is not obtained, a short circuit to ground exists.

A short could be caused by poor primary lead wire insulation, a shorted condenser or a short between the breaker arm and breaker plate.

MECHANICAL OPERATION

1. Turn the test selector to the SYNCHRO. position and check to make sure the drive chuck is securely tightened on the distributor shaft.

2. Turn the motor control switch to the left for eight cylinder engines or to the right for six cylinder engines.

If it is necessary to reverse the rotation of the drive motor, turn the motor control switch to the off position and allow the chuck to come to a complete stop before reversing the switch.

3. Adjust the rpm control to vary the distributor speed between 400 and 4000 engine rpm or at the maximum speed of the engine on which the distributor is used. Erratic or thin faint flashes of light preceding the regular flashes as the speed of rotation is increased can be due to weak breaker arm spring tension or binding of the breaker arm on the pivot pin.

4. Operate the distributor at approximately 2500 engine rpm.

5. Move the protractor scale with the adjustment control so that the zero degree mark on the scale is opposite one of the neon flashes. The balance of all the flashes should come within 1°, plus or minus, evenly around the protractor scale. A larger variation than 1° or erratic or wandering flashes may be caused by a worn cam or distributor shaft or a bent distributor shaft.

DWELL ANGLE

1. Turn the cylinder selector to the figure corresponding to the number of lobes on the cam of the distributor being tested.

2. Turn the test selector switch to the cam angle position and operate the distributor at approximately 1000 engine rpm.

3. Adjust the distributor breaker point gap to the dwell angle shown in the specifications.

DISTRIBUTOR SPARK ADVANCE

The spark advance is checked to determine if the ignition timing advances in proper relation to engine speed and load.

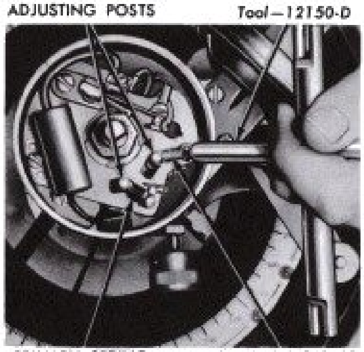


FIG. 23—Spark Advance Adjustment

FIG. 24—Centrifugal Advance Adjustment

Loadomatic Distributor

1. Check the breaker point contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension. Adjust if necessary.

Attach the vacuum adapter fitting to the vacuum unit and attach the vacuum hose between the distributor vacuum control and the vacuum outlet located at the upper right of the front panel. Check the zero setting of the vacuum gauge and if necessary, adjust the small knob at the lower edge of the dial rim, so that the vacuum gauge hand rests on zero.

Turn the vacuum supply switch to the on position.

3. Adjust the test set to 0° advance, 0 inch vacuum, and the initial rpm setting listed in the specifications.

4. Check the operation of the vacuum advance at the lowest and highest vacuum and rpm settings given in the specifications.

If the spark advance is not within the limits under low vacuum, the primary spring adjustment is at fault. If the spark advance is not within the limits under high vacuum, the secondary spring adjustment is at fault.

To adjust the spark advance, release the tension on the retard springs by turning the adjusting posts as required (Fig. 23). Adjust the primary spring (spring farthest from the vacuum chamber) first, for the low vacuum settings. Adjust the secondary spring last, for the high vacuum settings. As a final check, check the advance throughout the entire range.

If it is impossible to adjust both springs to give the correct spark advance throughout the range, one or both springs should be replaced and the spark advance readjusted. If the advance characteristics still can not be brought within specifications, replace the diaphragm assembly.

Dual Advance Distributor

1. Check the contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension and adjust it if necessary.

The dual advance distributor has two independently operated spark advance systems. Each system is adjusted separately. **Adjust the centrifugal advance before adjusting the vacuum advance.**

CENTRIFUGAL ADVANCE

1. Do not connect the test set vacuum line to the diaphragm. Set the test set to 0° advance and the initial rpm setting listed in the specifications.

2. Operate the distributor in the direction of rotation (counterclockwise) and slowly increase the rpm to the setting specified for the first advance reading listed in the specifications.

If the correct advance is not indicated at this rpm, stop the distributor and bend one spring adjustment bracket to change its tension (Fig. 24). **Bend the adjustment bracket away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decrease spring tension).** After the adjustment is made, identify the bracket.

3. After an adjustment has been made to one spring, check the minimum advance point again.

4. Operate the distributor at the specified rpm to give an advance

FIG. 25—Vacuum Advance Adjustment

just below the maximum. If this advance is not to specifications, stop the distributor and bend the other spring bracket to give the correct advance.

5. Check the advance at all rpm settings listed in the specifications. Operate the distributor both up and down the rpm range.

VACUUM ADVANCE

1. Connect the test set vacuum line to the fitting on the diaphragm and turn vacuum supply switch on.

2. Set the test set to 0° advance, 0 vacuum, and at 1000 rpm.

3. Check the advance at the first vacuum setting given in the specifications.

4. If the advance is incorrect, change the calibration washers between the vacuum chamber spring and nut (Fig. 25). After installing or removing the washers, position the gasket and tighten the nut. **The addition of a washer will decrease advance and the removal of a washer will increase advance.**

5. After one vacuum setting has been adjusted, the others should be checked. **Do not change the original rpm setting when going to a different vacuum setting.** If the other settings are not within limits, it indicates incorrect spring tension, leakage in the vacuum chamber and/or line, or the wrong fiber stop has been installed in the vacuum chamber of the diaphragm housing.

DISTRIBUTOR TESTS — ROTUNDA RE-236 TESTER

MOUNTING DISTRIBUTOR

1. Adjust the distributor support arm in relation to the distributor shaft length.

2. Set the distributor in the support arm and enter the lower end of the distributor shaft in the Syncrograph chuck.

3. Tighten the chuck on the distributor shaft using the wrench located near the support arm column.

4. Align the distributor shaft by shifting the support arm and distributor then tighten the clamp screw.

5. Clamp the distributor securely in the distributor support arm clamp so that it will not turn in its mounting.

MECHANICAL OPERATION

1. Turn the OFF, SET, CAM, SYNC. switch to SET.

2. Adjust the SET TACH control so that the tachometer pointer is on the SET line.

3. Turn the OFF, SET, CAM, SYNC. switch to SYNC. position.

4. Turn the MOTOR switch to the LEFT position for eight cylinder engines or to the RIGHT position for six cylinder engines.

5. Adjust the speed control to vary the distributor speed between 400 and 4000 engine rpm, or at the maximum speed of the engine on which the distributor is used. Erratic or thin faint flashes of light preceding the regular flashes as the speed of rotation is increased can be due to weak breaker arm spring tension or binding of the breaker arm on the pivot pin.

6. Operate the distributor at approximately 2500 engine rpm and move the protractor scale so that the zero degree mark on the scale is opposite one of the neon flashes. The balance of all the flashes should come within 1°, plus or minus, evenly around the protractor scale. A variation larger than 1° or erratic or wandering flashes may be caused by a worn cam or distributor shaft or a bent distributor shaft.

DWELL ANGLE TEST

1. Turn the OFF, SET, CAM, SYNC. switch to the CAM position. Operate the distributor at about 1000 rpm.

2. Adjust the breaker point gap until the cam angle is to specifications.

DISTRIBUTOR SPARK ADVANCE

The spark advance is checked to determine if the ignition timing advances in proper relation to engine speed and load.

Loadomatic Distributor

1. Check the breaker point contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension. Adjust it if necessary.

3. Adjust the test set to 0° advance, 0 inch vacuum, and the initial rpm setting listed in the specifications.

4. Check the operation of the vacuum advance at the lowest and highest vacuum and rpm settings given in the specifications.

If the spark advance is not within the limits under low vacuum, the primary spring adjustment is at fault. If the spark advance is not within the limits under high vacuum, the secondary spring adjustment is at fault.

To adjust the spark advance, release the tension on the retard springs by turning the adjusting posts as required (Fig. 23). Adjust the primary spring (spring farthest from the vacuum chamber) first, for the low vacuum settings. Adjust the secondary spring last, for the high vacuum settings. As a final check, check the advance throughout the entire range.

If both springs cannot be adjusted to give the correct spark advance throughout the range, one or both springs should be replaced and the spark advance readjusted. If the advance characteristics still can not be brought within specifications, replace the diaphragm assembly.

Dual Advance Distributor

1. Check the contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension and adjust it if necessary.

The dual advance distributor has two independently operated spark advance systems. Each system is adjusted separately. **Adjust the centrifugal advance before adjusting the vacuum advance.**

CENTRIFUGAL ADVANCE

1. Do not connect the test set vacuum line to the diaphragm. Set the test set to 0° advance and the initial rpm setting listed in the specifications.

2. Operate the distributor in the direction of rotation (counterclockwise) and slowly increase the rpm to the setting specified for the first advance reading listed in the specifications.

If the correct advance is not indicated at this rpm, stop the distributor and bend one spring adjustment bracket to change its tension (Fig. 24). Bend the adjustment bracket away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decrease spring tension). After the adjustment is made, identify the bracket.

3. After an adjustment has been made to one spring, check the minimum advance point again.

4. Operate the distributor at the specified rpm to give an advance just below the maximum. If this advance is not to specifications, stop the dis-

tributor and bend the other spring bracket to give the correct advance.

5. Check the advance at all rpm settings listed in the specifications. Operate the distributor both up and down the rpm range.

VACUUM ADVANCE

1. Connect the test set vacuum line to the fitting on the diaphragm.

2. Set the test set to 0° advance, 0 vacuum, and at 1000 rpm.

Check the advance at the first vacuum setting given in the specifications.

4. If the advance is incorrect, change the calibration washers between the vacuum chamber spring and nut (Fig. 25). After installing or removing the washers, position the gasket and tighten the nut. **The addition of a washer will decrease advance and the removal of a washer will increase advance.**

5. After one vacuum setting has been adjusted, the others should be checked. **Do not change the original rpm setting when going to a different vacuum setting.** If the other settings are not within limits, there is incorrect spring tension, leakage in the vacuum chamber and/or line, or the wrong fiber stop has been installed in the vacuum chamber of the diaphragm housing.

DISTRIBUTOR TESTS — SUN DT-600 TESTER

MOUNTING

1. Using the elevation crank, raise the clamp arms high enough to permit the shaft of the distributor to clear the drive chuck.

2. Position the distributor in the clamp with the vacuum diaphragm pointing towards the right. Tighten the clamp arms securely around the distributor body. Install the proper adapter to the vacuum diaphragm on dual advance and loadomatic distributors.

3. Lower the distributor with the elevation crank until the gear or ¾ inch of the tip of the distributor shaft enters the drive chuck, or until the shaft engages the adapter if an adapter is being used. **Do not bottom the distributor shaft in the chuck.**

4. Tighten the chuck. **Do not try to raise or lower the distributor after the chuck has been tightened.**

CONDENSER TESTING

Condensers should be tested for series resistance, capacity and leakage. The preparation procedure is as follows:

1. Trip the motor switch to the proper position for the rotation of the distributor being tested.

2. Turn the condenser test selector switch to the series resistance (SERIES RES.) position and connect the condenser test leads together.

3. Turn the condenser calibrate control clockwise from the OFF position.

4. Allow the tester to warm up for approximately 30 seconds and then adjust the calibrate control until the condenser meter reads on the set line.

5. Rotate the distributor shaft until the cam holds the breaker points open.

6. Separate the test leads and connect one to the distributor primary lead and the other to the distributor body.

Series Resistance. With the condenser test selector switch in the SERIES RES. position, the condenser meter should read in the black bar on the right end of the scale.

Capacity. Turn the condenser test selector switch to the capacity position. The condenser meter will now read the capacity in microfarads. Compare this reading with specifications.

Leakage. Turn the condenser test selector switch to the leakage position. The condenser meter should read in the black bar at the left of the scale.

Turn the test selector switch to the series resistance position and turn off the condenser calibrator before disconnecting the test leads.

DISTRIBUTOR RESISTANCE

1. With the motor switch in the proper position for the rotation of the distributor being tested and the speed set at zero rpm, clip the tester's distributor and ground lead together.

2. Set the tach-dwell selector switch to the calibrate position and adjust the dwell regulator until the dwell meter reads on the set line.

3. Separate the leads and connect the tester's distributor lead to the distributor primary lead. The tester ground lead should now be connected to the distributor body.

4. Rotate the chuck by hand until the points are closed. The dwell meter should read in the black bar at the right end of the scale.

If it does not read in the black bar, move the tester's distributor wire step by step through the circuit toward the ground. When there is a measurable difference between two points, check that area for the cause of the resistance.

CAM LOBE ACCURACY

1. Connect the test leads following the directions in the distributor resistance test.

2. Turn the tach-dwell switch to the position corresponding to the number of cylinders on the car from which the distributor was removed.

3. Adjust the distributor speed to 1000 rpm.

4. Rotate the degree ring of the tester until the zero on the ring lines up with one of the flashes.

5. Observe the positions of the remaining flashes. If the flashes are not evenly spaced (within ±1°), check for a worn cam, worn distributor shaft or a bent distributor shaft.

DWELL ANGLE

This test has the same connections as the preceding test, therefore they can be done at the same time.

Adjust the speed to 200 rpm and notice the dwell reading. If it is not within specifications, adjust the points until the proper dwell is obtained. Now increase the speed and check the dwell reading. If the reading changes more than 2 degrees, check for a worn distributor shaft or worn bushings.

DISTRIBUTOR SPARK ADVANCE

The spark advance is checked to determine if the ignition timing advances in proper relation to engine speed and load.

Loadomatic Distributor

1. Check the breaker point contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension and adjust it if necessary.

3. Adjust the test set to 0° advance, 0 inch vacuum and the initial rpm setting listed in the specifications.

4. Check the operation of the vacuum advance at the lowest and highest vacuum and rpm settings given in the specifications.

If the spark advance is not within the limits under low vacuum, the primary spring adjustment is at fault. If the spark advance is not within

the limits under high vacuum, the secondary spring adjustment is at fault.

To adjust the spark advance, release the tension on the retard springs by turning the adjusting posts as required (Fig. 23). Adjust the primary spring (spring farthest from the vacuum chamber) first, for the low vacuum settings. Adjust the secondary spring last, for the high vacuum settings. As a final check, check the advance throughout the entire range.

If it is impossible to adjust both springs to give the correct spark advance throughout the range, one or both springs should be replaced and the spark advance readjusted. If the advance characteristics still can not be brought within specifications, replace the diaphragm assembly.

Dual Advance Distributor

1. Check the contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension and adjust it if necessary.

The dual advance distributor has two independently operated spark advance systems. Each system is adjusted separately. **Adjust the centrifugal advance before adjusting the vacuum advance.**

CENTRIFUGAL ADVANCE

1. Do not connect the test set vacuum line to the diaphragm. Set the test set to 0° advance and the initial rpm setting listed in the specifications.

2. Operate the distributor in the direction of rotation (counterclockwise) and slowly increase the rpm to the setting specified for the first advance reading listed in the specifications.

If the correct advance is not indicated at this rpm, stop the distributor and bend one spring adjustment bracket to change its tension (Fig. 24). **Bend the adjustment bracket away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decrease spring tension).** After the adjustment is made, identify the bracket.

3. After an adjustment has been made to one spring, check the minimum advance point again.

4. Operate the distributor at the specified rpm to give an advance just below the maximum. If this advance is not to specifications, stop the distributor and bend the other spring bracket to give the correct advance.

5. Check the advance at all rpm settings listed in the specifications. Operate the distributor both up and down the rpm range.

VACUUM ADVANCE

1. Connect the test set vacuum line to the fittings on the diaphragm.

2. Set the test set to 0° advance, 0 vacuum, and at 1000 rpm.

3. Check the advance at the first vacuum setting given in the specifications.

4. If the advance is incorrect, change the calibration washers between the vacuum chamber spring and nut (Fig. 25). After installing or removing the washers, position the gasket and tighten the nut. **The addition of a washer will decrease the advance and the removal of a washer will increase the advance.**

5. After one vacuum setting has been adjusted, the others should be checked. **Do not change the original rpm setting when going to a different vacuum setting.** If the other settings are not within limits, it indicates incorrect spring tension, leakage in the vacuum chamber and/or line, or the wrong fiber stop has been installed in the vacuum chamber of the diaphragm housing.

2 COMMON ADJUSTMENTS AND REPAIRS

BREAKER POINTS

ADJUSTMENT

New Breaker Points. New breaker points can be adjusted with a feeler gauge, scope or a dwell meter.

To adjust the breaker points with a feeler gauge:

1. Check and adjust the breaker point alignment. Rotate the distributor cam until the rubbing block rests on the peak of a cam lobe.

2. Insert the correct blade of a clean feeler gauge between the breaker points (Fig. 26). The gap should be set to the larger opening because the rubbing block will wear down slightly while seating to the cam.

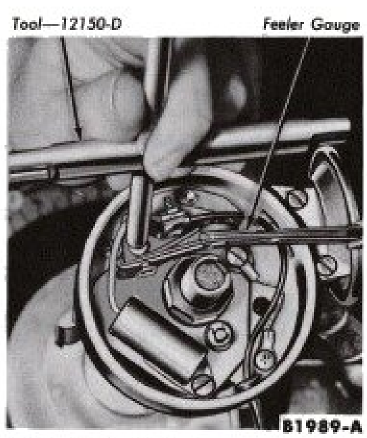


FIG. 26—Adjusting New Breaker Point Gap

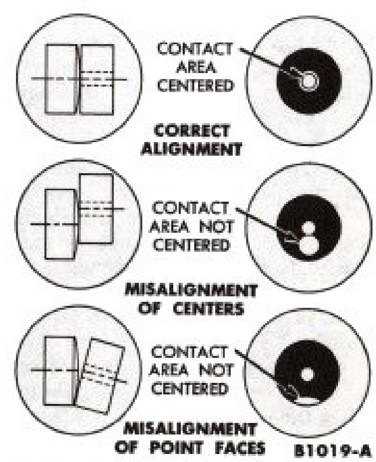


FIG. 27—Breaker Point Alignment

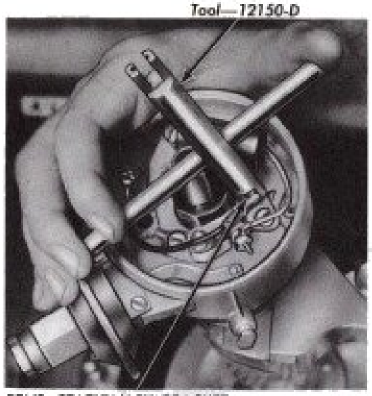


FIG. 28—Aligning Breaker Points

3. Apply a light film of distributor cam lubricant to the cam when new points are installed. **Do not use engine oil to lubricate the distributor cam.**

4. Set the ignition timing.

If a scope or a dwell meter is used to adjust new points, be sure the points are in proper alignment. Also, set the contact dwell to the low setting. New points must be set to the low dwell as the rubbing block will wear down slightly while seating to the cam.

Used Breaker Points. If the gap of used breaker points is being checked, use a scope or a dwell meter to test the contact dwell. It is not advisable to use a feeler gauge to adjust or to check the gap of used breaker points because the roughness of the points makes an accurate gap reading or setting impossible. Clean the breaker points. Check the contact dwell following the instructions under "Ignition System Tests." The contact dwell should be to specifications. Check and adjust the ignition timing.

FIG. 29—Checking Breaker Point Spring Tension

ALIGNMENT

The vented-type breaker points must be accurately aligned and strike squarely in order to realize the full advantages provided by this design, and assure normal breaker point life. Any misalignment of the breaker point surfaces will cause premature wear, overheating and pitting.

1. Turn the cam so that the breaker points are closed and check the alignment of the points (Fig. 27).

2. Align the breaker points to make full face contact by bending the stationary breaker point bracket (Fig. 28). **Do not bend the breaker arm.**

3. After the breaker points have been properly aligned, adjust the breaker point gap or dwell.

ADJUSTING SPRING TENSION

Correct breaker point spring tension is essential to proper engine operation and normal breaker point life. If the spring tension is too great, rapid wear of the breaker arm rubbing block will result, causing the breaker point gap to close up and retard the spark timing. If the spring tension is too weak, the breaker arm will flutter at high engine rpm resulting in an engine miss.

To check the spring tension, place the hooked end of the spring tension gauge over the movable breaker point. Pull the gauge at a right angle (90°) to the movable arm until the breaker points just start to open (Fig. 29). If the tension is not within specifications, adjust the spring tension.

To adjust the spring tension (Fig. 30):

1. Disconnect the primary lead wire and the condenser lead at the breaker point assembly primary terminal.

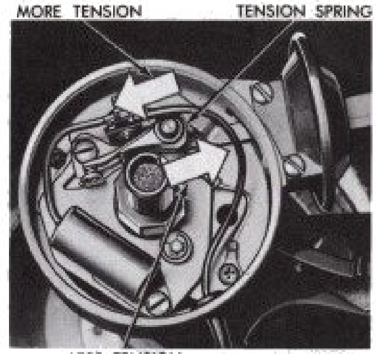


FIG. 30—Adjusting Spring Tension

2. Loosen the nut holding the spring in position. **Move the spring toward the breaker arm pivot to decrease tension and in the opposite direction to increase tension.**

3. Tighten the lock nut, and then check spring tension. Repeat the adjustment until the specified spring tension is obtained.

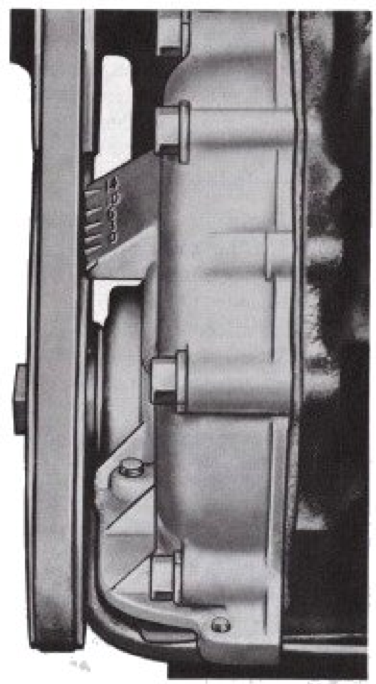


FIG. 31—Six Cylinder Timing Marks

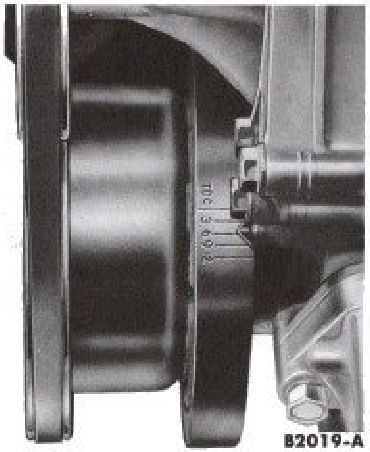


FIG. 32—V-8 Timing Marks

4. Install the primary lead wire, and the condenser lead with the lock washer and tighten the nut securely.

IGNITION TIMING

TIMING MARK LOCATIONS

144 and 170 C.I.D. Six Cylinder Engines. The timing pointer (Fig. 31), has five timing marks ranging from top dead center (TDC) to 14° before top dead center (BTDC). The crankshaft pulley or damper has a timing notch. To adjust ignition timing, align the notch on the pulley or damper with the proper timing mark on the timing pointer.

V-8 Engines. The crankshaft damper for the 260 and 289 V-8's has five timing marks ranging from top dead center (TDC) to 12° before top dead center (BTDC).

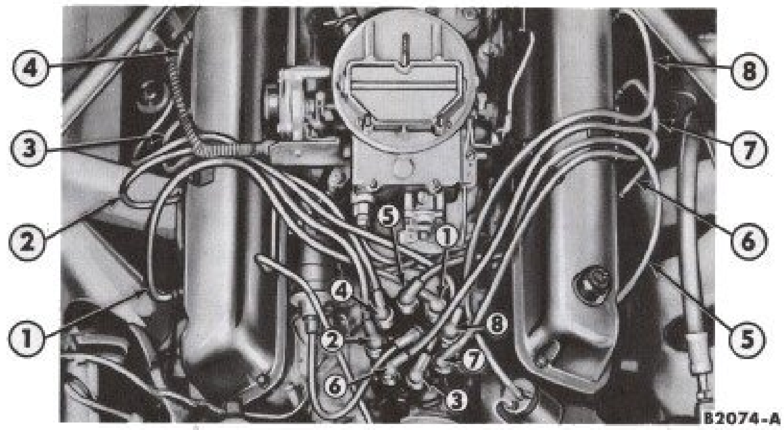


FIG. 34—V-8 Ignition Wiring

To adjust the ignition timing, align the pointer with the proper timing mark on the damper (Fig. 32).

ADJUSTMENT

The procedure for adjusting the ignition timing is covered under timing mark on the damper (Fig. 32).

SPARK PLUG WIRE REPLACEMENT

When removing the wires from the spark plugs, grasp the moulded cap only. Do not pull on the wire because the wire connection inside the cap may become separated or the weather seal may be damaged.

144 AND 170 C.I.D. SIX CYLINDER ENGINES

The ignition wire installation is shown in Fig. 33.

Removal

1. Disconnect the wires at the spark plugs and at the distributor cap.

2. Remove the coil high tension lead.

Installation

1. Connect the wires to the proper spark plugs.

2. Insert the ends of the wires in the correct sockets in the distributor cap. Be sure the wires are forced all the way down into their sockets and that they are held firmly in position. The No. 1 socket is identified on the cap. Install the wires in a clockwise direction in the firing order (1-5-3-6-2-4) starting at the No. 1 socket.

3. Install the coil high tension lead. Push all weatherseals into position.

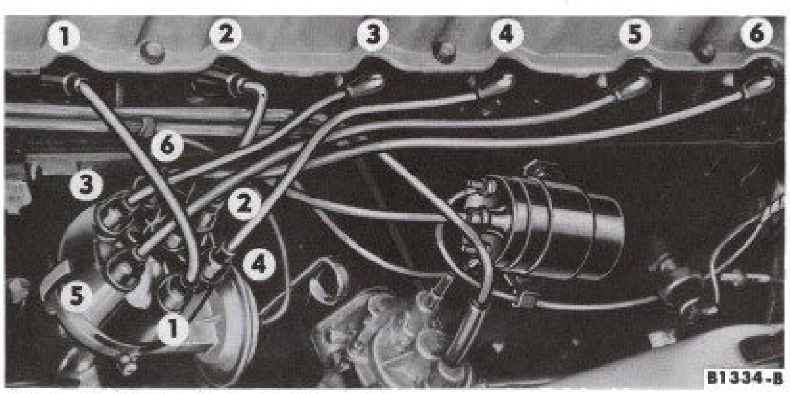


FIG. 33—Six Cylinder Ignition Wiring

FIG. 35—Gapping Spark Plug

ALL V-8 ENGINES

A typical ignition wiring installation is shown in Fig. 34.

Removal

1. Disconnect the wires from the spark plugs and distributor cap.
2. Pull the wires from the brackets on the valve rocker arm covers and remove the wires.
3. Remove the coil high tension lead.

Installation

1. Insert each wire in the proper socket of the distributor cap. Be sure the wires are forced all the way down into their sockets. The No. 1 socket is identified on the cap. Install the wires in a counterclockwise direction in the firing order (1-5-4-2-6-3-7-8) starting at the No. 1 socket. Cylinders are numbered from front to rear; right bank 1-2-3-4, left bank 5-6-7-8.
2. Remove the brackets from the old spark plug wire set and install them on the new set in the same relative position. Install the wires in the brackets on the valve rocker arm covers (Fig. 34). Connect the wires to the proper spark plugs. Install the coil high tension lead. **Be sure the No. 7 spark plug wire is positioned in the bracket as shown in Fig. 34.**

SPARK PLUGS

REMOVAL

1. Remove the wire from each spark plug by grasping the moulded cap of the wire only. **Do not pull on the wire because the wire connection inside the cap may become separated or the weather seal may be damaged.**
2. Clean the area around each spark plug port with compressed air, and then remove the spark plugs.

ADJUSTMENT

Set the spark plug gap (0.032-0.036 inch) by bending the ground electrode (Fig. 35).

INSTALLATION

1. Install the spark plugs and torque each plug to 15-20 ft-lbs.

When a new spark plug is installed in a new replacement cylinder head, torque the plug to 20-30 ft-lbs.

2. Connect the spark plug wires. Push all weatherseals into position.

RESISTANCE WIRE REPLACEMENT

The primary resistance wire is checked for excessive resistance as outlined under "Resistance Wire Test."

To replace the resistance wire:

1. Cut the brown wire and the red wire (with a green band) from the upper quick disconnect at the dash panel. Cut the wires as close to the quick disconnect as possible.
2. Solder a male bullet-type terminal to the brown wire and to the red wire (with a green band). Make a single terminal of the two wires. Using a female bullet terminal connector, connect the wires to one end of the service replacement resistance wire. **Do not splice the resistance wire.**
3. Drill a ¾-inch hole through one of the accessory dimples in the dash panel.
4. Install a grommet into the hole drilled in the dash panel.
5. Thread one end of the service replacement resistance wire through the grommet in the dash panel and connect it to the jumper wire at the ignition switch. Make sure the wire is routed through the retaining clips.
6. Cut off and discard (at the point where it enters the taped area) the length of defective resistance wire which is not enclosed in the taped portion of the wiring assembly.

3 CLEANING AND INSPECTION

SPARK PLUGS

Clean the plugs on a sand blast cleaner, following the manufacturer's instructions. **Do not prolong the use of the abrasive blast as it will erode the insulator.** Remove carbon and other deposits from the threads with a stiff wire brush. Any deposits will retard the heat flow from the plug to the cylinder head causing spark plug overheating and pre-ignition.

Clean the electrode surfaces with a small file (Fig. 36). Dress the electrodes to secure flat parallel surfaces on both the center and side electrode.

After cleaning, examine the plug carefully for cracked or broken insulators, badly pitted electrodes, and other signs of failure. Replace as required.

FIG. 36–Cleaning Plug Electrode

Examine the firing ends of the spark plugs noting the type of deposits and the degree of electrode erosion. Refer to Fig. 37 for the various types of spark plug fouling and their causes.

DISTRIBUTORS

Soak all parts of the distributor assembly (except the condenser, breaker point assembly, lubricating wick, vacuum diaphragm, distributor base oil seal, and electrical wiring) in a mild cleaning solvent or mineral spirits. Do not use a harsh cleaning solution. Wipe all parts that can not be immersed in a solvent with a clean dry cloth.

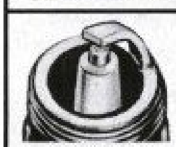
CONDITION	IDENTIFICATION	CAUSED BY
 OIL FOULING	Wet, sludgy deposits.	Excessive oil entering combustion chamber through worn rings and pistons, excessive clearance between valve guides and stems, or worn or loose bearings.
 GAS FOULING	Dry, black, fluffy deposits.	Incomplete combustion caused by too rich a fuel-air mixture or by a defective coil, breaker points or ignition cable.
 BURNED OR OVERHEATING	White, burned, or blistered insulator nose and eroded electrodes.	Inefficient engine cooling, or engine overheating caused by improper ignition timing, wrong type of fuel, loose spark plugs, or too hot a plug, low fuel pump pressure.
 NORMAL CONDITIONS	Rusty brown to grayish-tan powder deposit and minor electrode erosion.	Regular or unleaded gasoline.
 NORMAL CONDITIONS	White, powdery deposits.	Highly leaded gasolines.
 CARBON FOULING	Hard, baked on black carbon.	Too cold a plug. Weak ignition, defective fuel pump, dirty air cleaner, too rich a fuel mixture.
 SILICONE DEPOSIT	Hard and scratchy	Formed when fine sand particles combine with anti-knock compounds in the fuel. Most common industry areas. The plugs cannot be cleaned.
 SPLASHED FOULING		Deposits, accumulated after a long period of misfiring, suddenly loosened when normal combustion chamber deposits are restored after new plugs are installed. During a high speed run these deposits are thrown into the plug. B1005-E

FIG. 37—Spark Plug Inspection

After foreign deposits have been loosened by soaking, scrub the parts with a soft bristle brush. **Do not use a wire brush, file, or other abrasive object.** Dry the parts with compressed air.

Examine the bushing surface of the distributor shaft and the bushing for wear. On all distributors, the minimum allowable shaft diameter at the bushing is 0.4675 inch and the maximum allowable inside diameter of the bushing is 0.4690 inch. Replace worn parts.

Inspect the distributor cam lobes for scoring and signs of wear. If any lobe is scored or worn, replace the cam assembly (dual advance distributor) or the shaft (loadomatic distributor).

Inspect the breaker plate assembly for signs of distortion. In addition, on the dual advance distributor, inspect the stationary sub-plate for worn nylon contact buttons. Replace the breaker plate assembly if it is defective.

The breaker point assembly and condenser should be replaced whenever the distributor is overhauled.

Inspect all electrical wiring for fraying, breaks, etc., and replace any that are not in good condition.

Check the distributor base for cracks or other damage.

Check the diaphragm housing, bracket, and rod for damage. Check the vacuum line fitting for stripped threads or other damage. Test the vacuum fittings, case, and diaphragm for leakage as explained under "Distributor Tests." Replace all defective parts.

PART 9-2 LOADOMATIC DISTRIBUTORS

1 DESCRIPTION AND OPERATION

The direction of distributor rotation is clockwise as viewed from the top of the distributor.

144 AND 170 CID ENGINES

Engine speed and load requirements are satisfied by the action of the breaker plate which is controlled by a vacuum-actuated diaphragm working against the tension of two calibrated breaker plate springs (Fig. 1). The breaker plate is free to rotate on the shaft bushing. The diaphragm moves the breaker plate in a counterclockwise direction to advance the spark, and the springs move the plate in a clockwise direction to retard the spark. The degree of spark advance is determined by the strength of the vacuum acting on the diaphragm.

Vacuum is transmitted to the distributor diaphragm from two interconnected passages in the carburetor (Fig. 2). The opening of one passage is in the throat of the venturi and the opening(s) of the other passage is in the throttle bore just above the closed throttle plate.

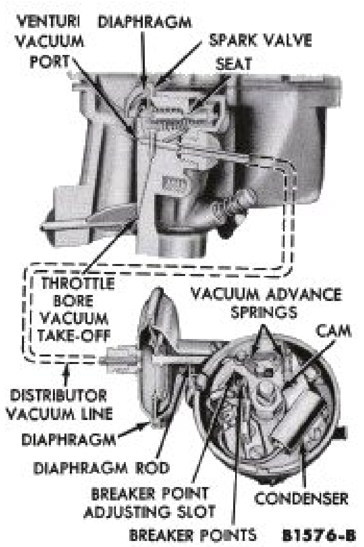


FIG. 2—Spark Advance Controls

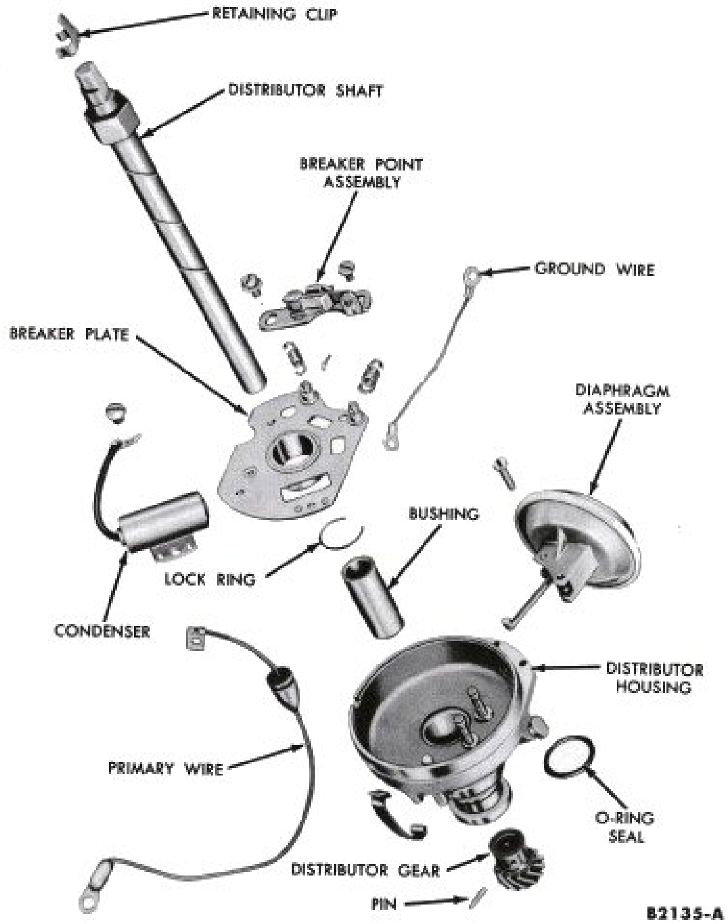


FIG. 1—Typical Loadomatic Distributor Assembly

All manifold vacuum to the distributor passes through a spark control valve located in the carburetor throttle body or main body. Under steady part throttle operation, the spark valve is held open against the pressure of a calibrated spring. A combination of atmospheric pressure outside the spark valve diaphragm and manifold vacuum from within holds the spark valve open. When accelerating, manifold vacuum momentarily drops below a predetermined point and the calibrated spring closes the spark valve shutting off the manifold vacuum port. Vacuum from the venturi prevents full spark retard.

As engine speed approaches the throttle setting, manifold vacuum increases sufficiently to open the spark valve and allow a higher vacuum to operate the distributor.

At high engine speed, manifold vacuum falls and the valve closes. This prevents loss of venturi vacuum

due to bleed back caused by the lower manifold vacuum. This assures full spark advance at high engine speed.

The spark valve functions in a similar manner to provide an intermediate spark retard whenever the load on the engine is increased to a degree where normal road load spark advance would be too great and the wide-open throttle spark retard would reduce the efficiency of the engine.

2 IN-CAR ADJUSTMENT AND REPAIRS

DISASSEMBLY

BREAKER POINT AND CONDENSER REMOVAL

1. Unsnap the distributor cap hold clips. Lift the cap off of the distributor housing and position it out of the way. Do not pull the spark plug wires out of the cap unless it is necessary to replace the cap.
2. Remove the rotor.
3. Disconnect the primary and condenser wires from the breaker point terminal (Fig. 3). Remove the condenser retaining screw and lift the condenser off of the breaker plate.

Remove the retaining screws and lift the breaker point assembly out of the housing.

VACUUM DIAPHRAGM REMOVAL

1. Unsnap the distributor cap hold down clips. Lift the distributor cap off of the distributor housing and position it out of the way. Do not pull the spark plug wires out of the cap unless it is necessary to replace the cap.
2. Loosen the vacuum fitting on the diaphragm and pull the vacuum line out.
3. Remove the vacuum advance hairpin retainer and push the rod out of the breaker plate.
4. Remove the screws securing the diaphragm to the distributor housing and remove the diaphragm.

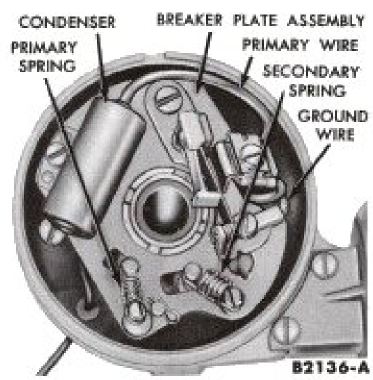


FIG. 3—Breaker Plate Installation

ASSEMBLY

VACUUM DIAPHRAGM INSTALLATION

1. Install the vacuum unit on the distributor body. Insert the tip of the vacuum rod through the breaker plate and attach the rod with the hairpin retainer.
2. Install the vacuum line in the diaphragm assembly and tighten the fitting.
3. Check the vacuum advance (Part 9-1).
4. Install the rotor and the distributor cap.

BREAKER POINT AND CONDENSER INSTALLATION

1. Place the breaker point assembly in position on the breaker plate. Be sure that the pivot pin enters the hole in the breaker plate. Connect the ground wire with the retaining screw to the end of the breaker point farthest from the adjustment slot. Install the other breaker point retaining screw.
2. Position the condenser and secure it with the retaining screw (Fig. 3).
3. Place the condenser lead, primary lead, lock washer and nut on the breaker point primary terminal. Tighten the nut.
4. Lubricate the cam with distributor cam lubricant. **Do not use engine oil on a distributor.**
5. Adjust the breaker point alignment, spring tension, and gap or dwell (Part 9-1).
6. Install the rotor and distributor cap.

ADJUSTMENTS

Refer to Part 9-1 for the proper procedures for adjusting the breaker points and spark advance.

3 REMOVAL AND INSTALLATION

REMOVAL

1. Disconnect the primary wire at the coil and remove the distributor cap.

2. Disconnect the vacuum line at the distributor.

3. Scribe a mark on the distributor body, indicating the position of the rotor, and scribe another mark on the body and engine block, indicating the position of the body in the block. These lines will be used as guides when installing the distributor in the correctly timed engine.

4. Remove the retaining screw(s) (Fig. 4) and lock washer(s) and lift the distributor out of the block.

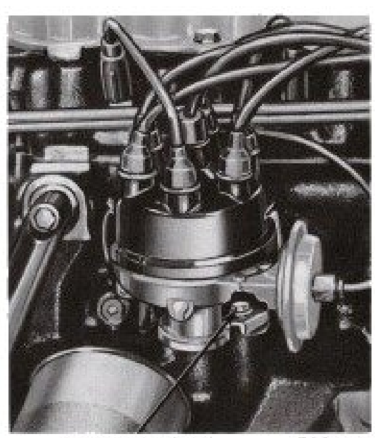


FIG. 4—Typical Loadomatic Distributor Mounting

Do not rotate the crankshaft while the distributor is removed, or it will be necessary to time the engine.

INSTALLATION

1. If the crankshaft has not been rotated while the distributor was removed, position the distributor in the block with the rotor aligned with the mark previously scribed on the distributor body.

2. Install the distributor retaining screw(s).

3. Connect the distributor primary wire and install the distributor cap.

4. Start the engine and check the ignition timing with a timing light.

Connect the distributor vacuum line, and check the advance with the timing light when the engine is accelerated.

If ignition timing is required, rotate the crankshaft until the No. 1 piston is on TDC after the compression stroke. Position the distributor in the block with the rotor at the No. 1 firing position. **Make sure the oil pump intermediate drive shaft is properly seated in the oil pump.** Install, but do not tighten, the distributor retaining screws. Rotate the distributor body clockwise until the breaker points are just starting to open. Tighten the retaining screws and follow steps 3 and 4 above.

4 MAJOR REPAIR OPERATIONS

BENCH DISASSEMBLY

The distributor assembly is shown in Fig. 1.

1. Remove the pin that retains the oil pump drive shaft in the distributor shaft, then remove the oil pump drive shaft.

2. Install the distributor in a vise.

3. Remove the rotor and retainer. On the distributor used with an automatic transmission, remove the vacuum connection, gasket, and calibration shim from the diaphragm assembly and remove the spring, stop, and calibration washer.

4. Remove the vacuum advance rod hair pin retainer. Push the rod out of the plate. Remove the vacuum unit from the distributor.

5. Disconnect the primary and condenser wires from the breaker point terminal. Pull the primary wire through the opening in the distributor, working from the inside of the distributor.

6. Remove the condenser.

7. Remove the breaker point assembly.

8. Release the tension on the return springs and disconnect the springs. **Do not stretch the springs as distortion may result, making it impossible to obtain an adjustment. If the springs are distorted, discard them.**

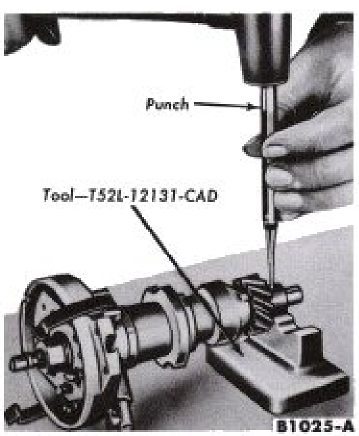


FIG. 5—Gear Pin Removal or Installation

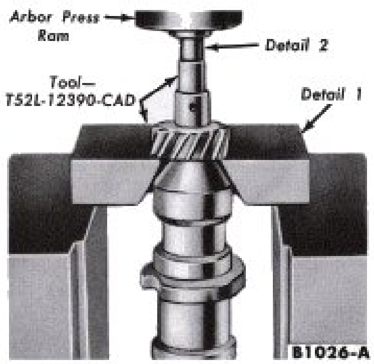


FIG. 6—Gear Removal

9. Remove the distributor from the vise. Remove the distributor cap clamps. Drive out the drive gear pin with a punch (Fig. 5).

10. If the gear and shaft are to be used again, mark the gear and shaft so that the pin holes can be easily aligned for assembly.

11. Press the gear off the shaft (Fig. 6). Slide the distributor shaft out of the body.

12. Position the distributor in a vise.

13. Remove the lock ring attaching the breaker plate to the upper bushing. Lift the breaker plate from the body.

14. Remove the ground wire.

15. Compress and insert the slotted end of the bushing removal tool in the distributor body. Allow it to expand and butt against the bushing. Drive out the bushing (Fig. 7).

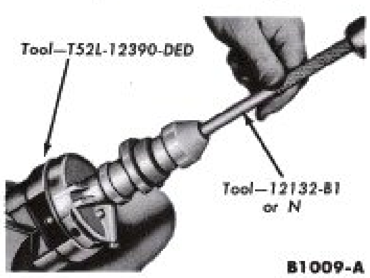


FIG. 7—Bushing Removal

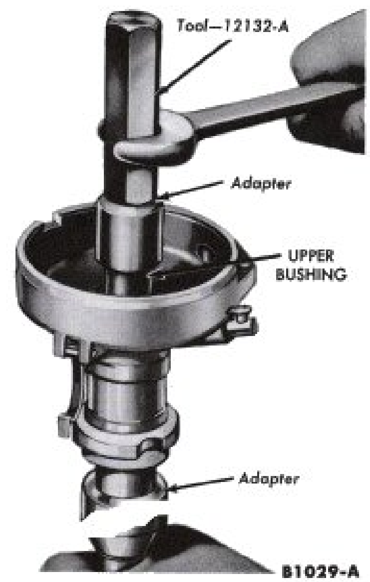


FIG. 8—Bushing Installation

BENCH ASSEMBLY

1. Oil the bushing and position it in the body with the lock ring end up. Install the bushing (Fig. 8). Turn the tool until the adapter bottoms firmly against the distributor body.

2. Burnish the bushing to the proper size (Fig. 9).

3. Install the ground wire. Position the breaker plate in the body. Install the lock ring to secure the plate.

4. Position a new breaker point assembly on the breaker plate. Be sure the pivot pin enters the hole in the breaker plate.

5. Connect the ground wire to the breaker plate at the end furthest from the adjustment slot. Install the other screw and lock washer at the opposite end of the assembly.

6. Install a new condenser. Pass the primary wire assembly through

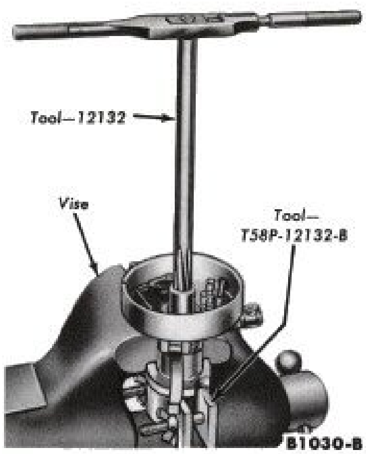


FIG. 9—Burnishing Bushing

the opening in the distributor, working from the inside to the outside of the distributor housing. Pull the wire through the opening until the locating stop is flush with the inside of the distributor. Place the condenser lead, primary lead, lock washer, and nut on the primary terminal.

7. Install the return springs on the adjustment and breaker plate posts.

Make certain that the secondary spring is installed adjacent to the vacuum chamber.

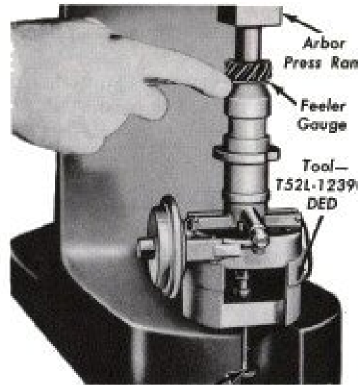
8. Install the vacuum unit on the distributor body.

9. Insert the tip of the vacuum rod through the breaker plate. Attach the rod with the hair pin retainer.

10. Slide the shaft into the body using care not to damage the rubbing block on the breaker points. **The shaft and gear are replaced as an assembly. One part should not be replaced without replacing the other.**

11. Place the spacer on the gear end of the shaft. Press the gear on the shaft (Fig. 10) until the specified end clearance is obtained. If a new shaft is being installed, drill the shaft with a ⅛-inch drill using the pin hole in the gear shoulder as a guide.

12. Install the pin through the gear and shaft (Fig. 42) and pean the pin if the solid-type pin is used. Install the distributor cap clamps. Lubricate the cam with distributor cam lubricant.



TIGHTEN SCREW JUST ENOUGH TO TAKE UP ALL END PLAY OF SHAFT IN HOUSING

B1031-A

FIG. 10—Gear Installation

13. Refer to Part 9-1 and adjust the breaker point spring tension, align the breaker points, and adjust the gap. Check the vacuum advance, and the breaker point dwell and resistance.

14. Insert the oil pump drive shaft into the end of the distributor shaft. Install the retaining pin.

PART 9-3 DUAL ADVANCE DISTRIBUTORS

1 DESCRIPTION AND OPERATION

The dual advance distributor (Fig. 1) has two independently operated spark advance systems. A centrifugal advance mechanism is located below the stationary sub-plate assembly, and a vacuum operated spark control diaphragm is located on the side of the distributor base. As speed increases, the centrifugal weights cause the cam to advance or move ahead with respect to the distributor drive shaft. The weights turn the cam by means of a stop plate that has two slots, which fit over the pins in the weights. The slots determine the maximum amount of advance and the rate of advance is controlled by calibrated springs.

The vacuum advance mechanism has a spring-loaded diaphragm which is connected to the breaker plate. The spring-loaded side of the diaphragm is airtight and is connected through a vacuum line to the carburetor throttle bore. When the throttle plates open, the distributor vacuum passage is exposed to manifold vacuum, which causes the diaphragm to move against the tension of the spring. This action causes the movable breaker plate to pivot on the stationary subplate. The breaker point rubbing block, which is positioned on the opposite side of the cam from the pivot pin, then moves against distributor rotation and advances the spark timing. As the movable breaker plate is rotated from retard position to full advance position, the dwell decreases slightly. This is because the breaker point rubbing block and the cam rotate on different axes.

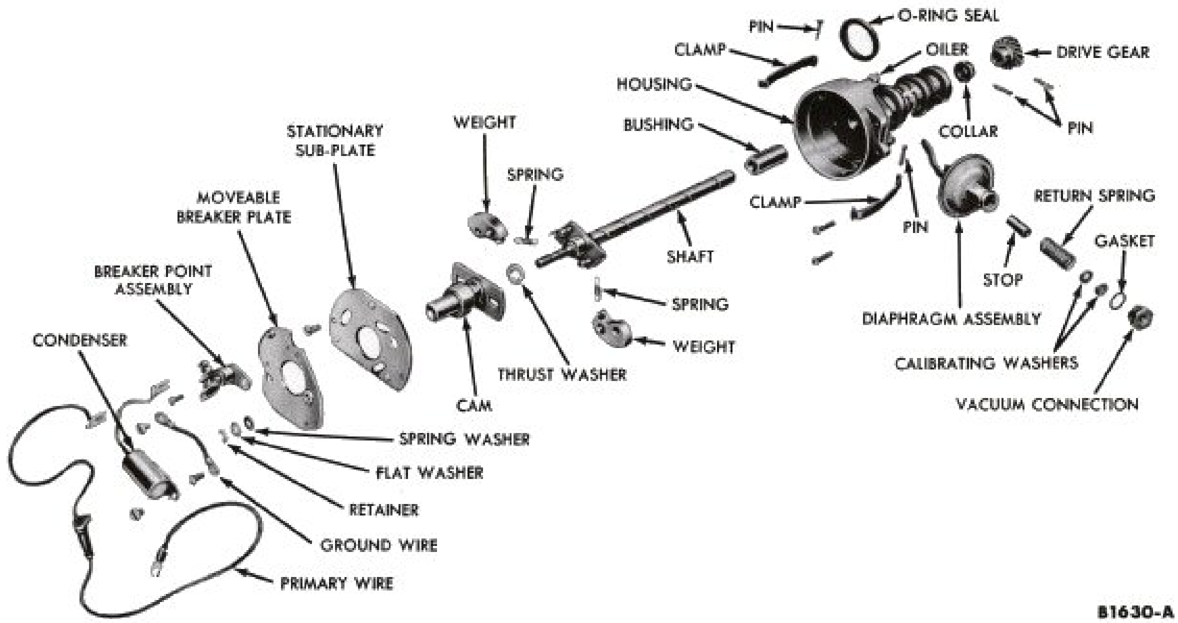


FIG. 1–Typical Dual Advance Distributor

2 IN-CAR ADJUSTMENT AND REPAIRS

DISASSEMBLY

REMOVAL OF COMPONENTS

1. Remove the primary wire from the coil. Unsnap the distributor cap retaining clips, lift the distributor cap off the distributor housing, and position the cap out of the way.

2. Loosen the nut and pull the vacuum line out of the diaphragm assembly.

3. Lift the rotor off the cam.

4. Remove the spring clip securing the diaphragm link to the movable breaker plate. Disconnect the diaphragm assembly from the distributor housing. Lift the diaphragm link off the pin and remove the diaphragm assembly.

5. Working from the inside of the distributor, remove the primary wire by pulling it through the opening in the distributor.

6. Remove the two retaining screws and lift the entire breaker plate assembly out of the distributor housing.

7. Lift the lubricating wick out of the cam. Using needle nose pliers, remove the cam retainer and lift the cam off the distributor shaft.

8. Lift the upper thrust washer off the distributor shaft. Carefully unhook and remove the distributor weight springs. Mark each spring and the adjusting bracket to which it is attached. Lift the weights out of the housing.

DIAPHRAGM AND BREAKER PLATE ASSEMBLY

1. Remove the vacuum connection and gasket, and then remove the calibrating washers, return spring, and stop.

2. Remove the retaining screw and lift the condenser off the breaker plate (Fig. 1).

3. Remove the retainer and washers securing the movable breaker plate to the stationary sub-plate.

ASSEMBLY

DIAPHGRAM AND BREAKER PLATE ASSEMBLY

1. Install the breaker point assembly on the breaker plate. Position a new condenser and secure it with the retaining screw.

2. Install the stop, return spring, and calibration washers, then position a new gasket on the vacuum connection. Install and tighten the vacuum connection.

INSTALLATION OF COMPONENTS

1. Install the weights in the housing. Then install the distributor weight springs on the adjusting brackets from which they were removed. Install the upper thrust washer on the distributor shaft.

2. Fill the grooves in the upper portion of the distributor shaft with distributor cam lubricant. Position the cam on the distributor shaft and install the cam retainer. Apply a light film of distributor cam lubricant to the cam lobes. Install the wick in the cam assembly. Saturate the wick with SAE 10W engine oil.

3. Position the stationary sub-plate in the distributor. Install one end of the ground wire under the plate retaining screw closest to the diaphragm mounting flange.

4. Position the entire breaker plate assembly in the distributor housing and secure it in place on the sub-plate by installing the washers and retainer. **Be sure the protruding edges of the spring washer are facing upward.**

5. Attach the ground wire to the breaker point attaching screw farthest from the breaker point adjustment slot. Working from inside the distributor housing, pass the primary wire assembly through the opening in the distributor body. From outside the distributor, pull the wire through the opening until the locating stop is flush with the inside of the distributor.

6. Connect the condenser wire and the primary lead wire to the breaker points.

7. Position the diaphragm assembly and hook the diaphragm link over the pin on the breaker plate. Install the diaphragm assembly retaining screws. Secure the diaphragm link with a spring retainer.

8. Adjust the breaker point spring tension, align the breaker points, and adjust the breaker point gap. Check the breaker point dwell and resistance. Check the centrifugal and vacuum advance (refer to "Distributor Tests").

9. Install the rotor and distributor cap.

10. Connect the primary wire.

ADJUSTMENTS

Refer to Part 9-1 for the proper procedures for adjusting the breaker points and spark advance.

3 REMOVAL AND INSTALLATION

REMOVAL

1. Disconnect the primary wire at the coil. Disconnect the vacuum advance line at the distributor. Remove the distributor cap.

2. Scribe a mark on the distributor body and engine block indicating the position of the body in the block, and scribe another mark on the distributor body indicating the position of the rotor. These marks can be used as guides when installing the distributor in a correctly timed engine.

3. Remove the distributor hold down cap screw and clamp. Lift the distributor out of the block.

INSTALLATION

The distributor installation for the 260 or 289 V-8 is shown in Fig. 2.

FIG. 2—260 and 289 V-8 Distributor Installation

1. If the crankshaft was rotated while the distributor was removed from the engine, it will be necessary to time the engine. Rotate the crankshaft until No. 1 piston is on TDC after the compression stroke. Align the TDC mark on the timing pointer with the timing pin on the crankshaft damper. Position the distributor in the block with the rotor at the No. 1 firing position.

Make sure the oil pump intermediate shaft properly engages the distributor shaft. It may be necessary to crank the engine with the starter, after the distributor drive gear is partially engaged, in order to engage the oil pump intermediate shaft.

Install, but do not tighten, the retaining clamp and screw. Rotate the distributor body counterclockwise until the breaker points are just starting to open. Tighten the clamp.

2. If the crankshaft has not been rotated, position the distributor in the block with rotor aligned with the mark previously scribed on the distributor body, and the marks on the distributor body and engine block in alignment. Install the retaining clamp.

3. Install the distributor cap.

4. Connect the primary wire to the coil.

5. Check the ignition timing with a timing light and adjust if necessary. Connect the vacuum line, and check the advance with the timing light when the engine is accelerated.

4 MAJOR REPAIR OPERATIONS

BENCH DISASSEMBLY

1. Remove the distributor and place it in a vise.

2. Remove the rotor. Remove the spring clip securing the diaphragm link to the movable breaker plate. Disconnect the diaphragm assembly from the distributor base.

3. Lift the diaphragm link off the pin and remove the diaphragm assembly.

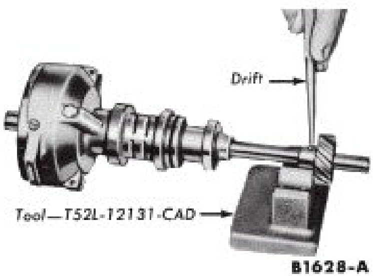


FIG. 3—Gear Pin Removal or Installation

4. Disconnect the primary lead wire and the condenser wire from the breaker point terminal.

5. Working from the inside of the distributor, remove the primary lead wire by pulling it through the opening in the distributor.

6. Remove the condenser.

7. Remove the breaker point assembly.

8. Remove the lubricating wick. Using needle nose pliers, remove the cam retainer.

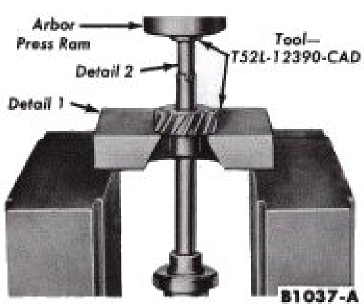


FIG. 4—Gear Removal

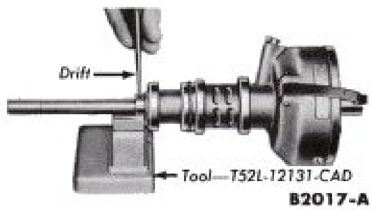


FIG. 5—Collar Retaining Pin Removal or Installation

9. Remove the movable breaker plate spring retainer and washers.

10. Remove the stationary sub-plate retaining screws. Remove the sub-plate, breaker plate, and cam as an assembly.

11. Remove the upper thrust washer.

12. Carefully unhook and remove the distributor weight springs. Mark each spring, bracket, and adjusting post to which it is attached.

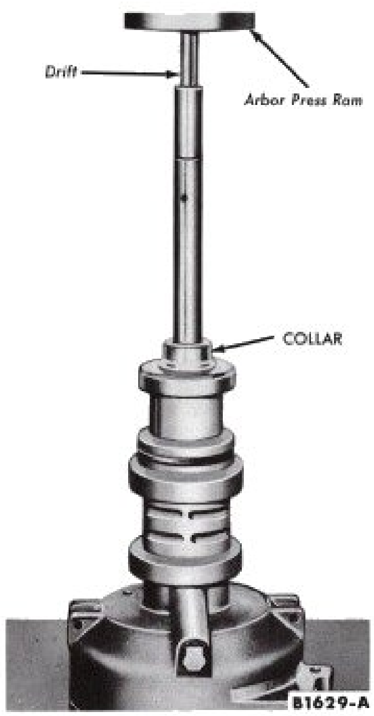


FIG. 6—Shaft Removal

13. Remove the weights.

14. Remove the distributor cap clamps.

15. **If the gear and shaft are to be used again, mark the gear and shaft so that the pin holes can be easily aligned for assembly.** Remove the gear roll pin (Fig. 3), and then remove the gear (Fig. 4).

16. Remove the shaft collar roll pin (Fig. 5).

17. Invert the distributor and place it on a support plate in a position that will allow the distributor shaft to clear the support plate and press the shaft out of the collar and the distributor housing (Fig. 6).

18. Remove the distributor shaft bushing (Fig. 7).

BENCH ASSEMBLY

ORIGINAL SHAFT AND GEAR

1. Oil the new bushing, and position it on the bushing replacer tool. Install the bushing (Fig. 8). When

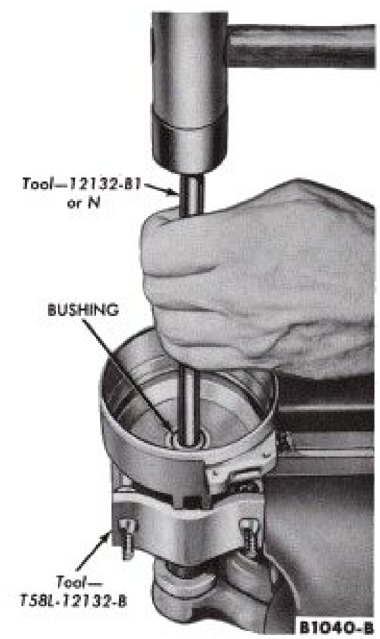


FIG. 7—Bushing Removal

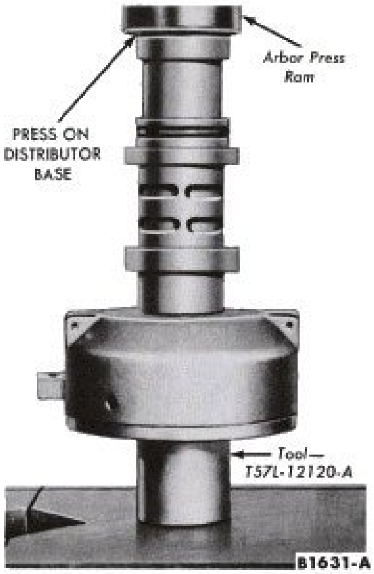


FIG. 8—Bushing Installation

the tool bottoms against the distributor base, the bushing will be installed to the correct depth.

2. Burnish the bushing to the proper size (Fig. 9).

3. Oil the shaft and slide it into the distributor body.

4. Place the collar in position on the shaft and align the holes in the collar and the shaft, then install a new pin (Fig. 52). Install the distributor cap clamps.

5. Check the shaft end play with a feeler gauge placed between the collar and the base of the distributor. If the end play is not within specifications, replace the shaft and gear.

6. Attach the distributor shaft supporting tool to the distributor. Tighten the backing screw in the tool enough to remove all shaft end play.

7. Install the assembly in a press. Press the gear on the shaft (Fig. 10), using the marks made on the

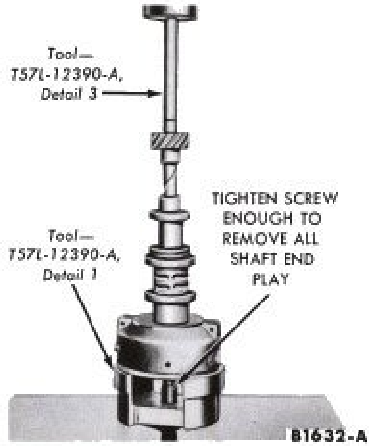


FIG. 10—Original Shaft and Gear Installation

gear and shaft as guides to align the pin holes.

8. Remove the distributor from the press. Install the gear retaining pin (Fig. 3).

9. Position the distributor in a vise. Fill the grooves in the weight pivot pin with a distributor cam lubricant.

10. Position the weights in the distributor.

11. Install the weight springs. Be sure the proper weight, spring, and adjustment bracket are assembled together.

12. Install the upper thrust washer.

13. Fill the grooves in the upper portion of the distributor shaft with a distributor cam lubricant.

14. Install the cam assembly (Fig. 11). Be sure that the slots in the cam engage the pins in the weights.

15. Install the cam retainer. Apply a light film of cam lubricant to the

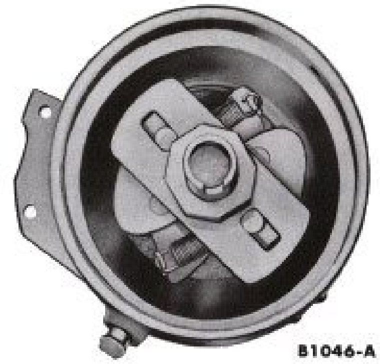


FIG. 12—Weights, Springs, and Cam Installed

cam lobes. Saturate the wick with SAE 10W engine oil. Install the wick in the cam assembly. The weights, springs, and cam are shown installed in Fig. 12.

16. Position the stationary subplate in the distributor. Install one end of the ground wire under the plate retaining screw closest to the diaphragm mounting flange (Fig. 13).

17. Position the movable breaker plate in the distributor. Install the spring washer on the pivot pin. Place the flat washer on the spring washer. Be sure the protruding edges of the spring washer are facing upward. Install the retainer.

18. Install a new breaker point assembly. Install the ground wire on the breaker point attaching screw furthest from the breaker point adjustment slot.

19. Install a new condenser.

20. Working from the inside to the outside of the distributor housing, pass the primary lead wire assembly through the opening in the

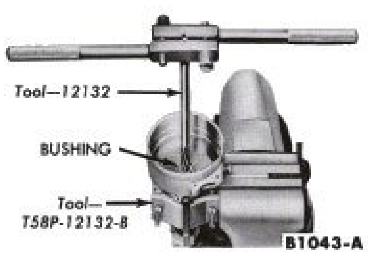


FIG. 9—Burnishing Bushing

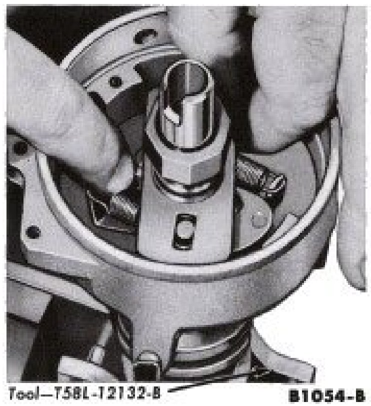


FIG. 11—Cam Installation

FIG. 13—Sub-Plate Installation

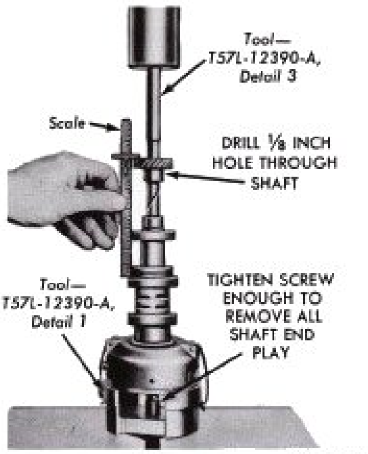


FIG. 14—New Shaft and Gear Installation

distributor. Pull the wire through the opening until the locating stop is flush with the inside of the distributor.

21. Connect the condenser wire and the primary lead wire to the breaker points.

22. Position the diaphragm assembly and hook the diaphragm link over the pin on the breaker plate. Install the diaphragm assembly retaining screws. Secure the diaphragm link with a spring retainer.

23. Refer to Part 9-1 and make the following adjustments:

Breaker point spring tension.

Align the breaker points and adjust the gap.

Check the breaker point dwell and resistance.

Centrifugal and vacuum advance.

NEW SHAFT AND GEAR

The shaft and gear are replaced as an assembly. One part should not be replaced without replacing the other. Refer to Fig. 1 for the correct location of the parts.

1. Follow steps 1, 2, and 3 under "Installing Original Shaft and Gear."

2. Attach the distributor shaft supporting tool to the distributor and install the assembly in a vise. Insert a 0.002-inch feeler gauge between the backing screw and the shaft. Tighten the backing screw on the tool enough to remove all shaft end play. Remove the feeler gauge and allow the shaft to rest on the backing screw. Slide the collar on the shaft. While holding the collar in place against the distributor base (Fig. 14), drill a ⅛-inch hole through the shaft using the access opening in the collar as a pilot.

3. Position the gear on the end of the shaft. Install the assembly in a press.

4. With the backing screw on the support tool tightened enough to remove all end play, press the gear on the shaft to the specified distance from the bottom face of the gear to the bottom face of the distributor mounting flange (Fig. 14). Drill a ⅛-inch hole through the shaft using the hole in the gear as a pilot.

5. Remove the distributor from the press and remove the support tool. Install the collar retaining pin (Fig. 5) and the gear retaining pin (Fig. 3).

6. Complete the assembly by following steps 8 thru 23 under "Installing Original Shaft and Gear."

PART 9-4 SPECIFICATIONS

DISTRIBUTOR

GENERAL

144 and 170 Six

Breaker Arm Spring Tension (Ounces)	17-20
Contact Spacing (Inches)	0.024-0.026
Dwell Angle at Idle Speed	35°-38°

260 and 289 V-8

Breaker Arm Spring Tension (Ounces)	17-20
Contact Spacing (Inches)	0.014-0.016
Dwell Angle at Idle Speed	26°-28½°

DIMENSIONS

Shaft End Play—Distributor Removed (Inches)

144 and 170 Six	0.022-0.033
260 and 289 V-8	0.024-0.035

Distance From Bottom of Mounting Flange to Bottom of Gear (Inches)

144 and 170 Six	2.510-2.515
260 and 289 V-8	4.031-4.038

CONDENSER

Capacity (Microfarads)	0.21-0.25
Minimum Leakage (Megohms)	5
Maximum Series Resistance (Ohms)	1

IGNITION TIMING

ENGINES	Recommended Setting (BTDC)**	
	Manual-Shift Transmission	Automatic Transmission
144 Six	*8°	*12°
170 Six	*6°	*12°
200 Six	—	*12°
260 (2-V) V-8	6°	10°
289 (4-V) V-8	6°	10°

*For altitude operation, and/or to obtain optimum engine performance and fuel economy, the initial ignition timing may be advanced 5° over the "normal" setting. No further improvement in engine performance or fuel economy will be achieved by advancing beyond this point. Advance the timing progressively until engine detonation (spark knock) is evident under actual road test acceleration. Retard the timing until the detonation (spark knock) is eliminated.

**If the individual requirements of the car and/or the use of sub-standard fuels dictate, the initial timing may have to be retarded from the recommended setting to eliminate detonation (spark knock). If retiming is necessary, it should be done progressively and not to exceed 2° BTC.

ADVANCE CHARACTERISTICS

Note: The advance characteristics given apply to the distributor with the indicated number only. The distributor number is stamped on the distributor housing or on a plate attached to the distributor housing.

144 Six (Distributor No. C4DF-12127-C Used With Manual-Shift Transmission)

VACUUM ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
500	1-2	0.30
800	5¼-6½	0.80
1200	8-9¼	1.85
1600	9¼-10½	3.00
2000	10¼-11¾	3.91

Maximum Advance Limit .... 14¾°

DISTRIBUTOR (Continued)

ADVANCE CHARACTERISTICS (Continued)

144 Six (Distributor No. C4DF-12127-D Used With Automatic Transmission)

VACUUM ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
500	1½-2½	0.35
800	3¾-4¾	0.80
1200	6-7	1.80
1600	7½-8½	3.11
2000	8½-9¾	4.1

Maximum Advance Limit .... 12¼°

170 Six (Distributor No. C4DF-12127-A Used With Manual-Shift Transmission)

VACUUM ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
500	1-2	0.30
800	5½-6¾	0.80
1200	9¾-11	1.80
1600	11½-13	3.00
2000	12¼-13¾	3.90

Maximum Advance Limit .... 15¾°

170 (Distributor No. C4DF-12127-B Used With Automatic Transmission)

VACUUM ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
500	1-2	0.35
800	3¼-4¼	0.80
1200	6¼-7¼	1.80
1600	8¼-10½	3.11
2000	9½-10¾	3.90

Maximum Advance Limit .... 14°

200 Six (Distributor No. C40F-12127-E Used With Automatic Transmission)

VACUUM ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
800	0-1	0.80
1200	3¼-4¼	1.90
1600	5¼-6¼	3.00
2000	6¼-7½	3.80

Maximum Advance Limit .... 12½°

DISTRIBUTOR (Continued)

ADVANCE CHARACTERISTICS (Continued)

260 V-8 (Distributor No. C40F-12127-A Used With Manual-Shift Transmission)

CENTRIFUGAL ADVANCE. Set the test stand at 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
500	0-1	0
800	3¼-4¼	0
1200	5¾-7	0
1600	8-9½	0
2000	9¾-11	0
Maximum Advance Limit....11°		

VACCUM ADVANCE. Set the test stand to 0° at 1000 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
1000	1-4	7
1000	5-8	10
1000	8-11	14
1000	9½-12½	20
Maximum Advance Limit....12½°		

260 V-8 (Distributor No. C40F-12127-B Used With Automatic Transmission)

CENTRIFUGAL ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
600	½-1½	0
800	2½-3½	0
1200	4¾-6	0
1600	7¼-8½	0
2000	9½-11	0
Maximum Advance Limit....Not applicable		

VACUUM ADVANCE. Set the test stand to 0° at 1000 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
1000	1-4	8
1000	5½-8½	12
1000	7½-10½	16
1000	8-11	20
Maximum Advance Limit....11°		

289 V-8 (Distributor No. C4GF-12127-A Used With Manual-Shift Transmisission)

CENTRIFUGAL ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
500	1¼-2¼	0
600	3¼-4¼	0
1000	7¾-9	0
1500	10¼-11¾	0
2000	12¼-14	0
Maximum Advance Limit....14°		

DISTRIBUTOR (Continued)

ADVANCE CHARACTERISTICS (Continued)

VACUUM ADVANCE. Set the test stand to 0° at 1000 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
1000	1-4	8
1000	5½-8½	12
1000	7½-10½	16
1000	8-11	20
Maximum Advance Limit....11°		

289 V-8 (Distributor No. C4GF-12127-B Used With Automatic Transmission)

CENTRIFUGAL ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
600	1-2	0
700	3-4¼	0
990	6-6¾	0
1500	8-9¼	0
2000	9¾-11	0
Maximum Advance Limit....11°		

VACUUM ADVANCE. Set the test to 0° at 1000 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
1000	2-5	8
1000	7-10	12
1000	9-12	16
1000	9½-12½	20
Maximum Advance Limit....12½°		

SPARK PLUGS

Engines	Type	Size	Gap (Inches)	Torque (Ft-lbs)
144-170-200	BF-82	18MM	0.032-0.036	15-20
260	BF-42	18MM	0.032-0.036	15-20
289	BF-32	18MM	0.032-0.036	15-20

COIL

Primary Resistance (Ohms)*	1.40-1.54 (75°F.)
Secondary Resistance (Ohms)	8000-8800 (75°F.)
Amperage Draw—Engine Stopped	4.5
—Engine Idling	2.5
*Primary Circuit Resistor	1.30-1.40 (75°F.)

FUEL SYSTEM

GROUP 10

PART 10-1 GENERAL FUEL SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

FUEL TANK, LINES AND FILTER

Water and dirt that accumulate in the fuel tank can cause a restricted fuel line or filter and malfunction of the vapor discharge valve, fuel pump, or carburetor. Condensation, which is the greatest source of water entering the fuel tank, is formed by moisture in the air when it strikes the cold interior walls of the fuel tank.

If the accumulation of sediment in the filter is excessive, the fuel tank should be removed and flushed, and the line from the fuel pump to the tank should be blown out.

Leakage in the fuel inlet line can cause low vacuum, pressure and volume conditions, and loss of fuel.

A restricted fuel tank vent can cause low fuel pump pressure and volume and may, in some instances, result in collapsed inlet hoses or a collapsed fuel tank.

FUEL PUMP

Incorrect fuel pump pressure and low volume (flow rate) are the two most likely fuel pump troubles that will effect engine performance. Low pressure will cause a lean mixture at high speeds and excessive pressure will cause high fuel consumption and carburetor flooding. Low volume will cause fuel starvation at high speeds.

Two tests: fuel pump static pressure and fuel volume are necessary to determine that the fuel pump is in satisfactory condition.

If both the fuel pump volume and pressure are within specifications

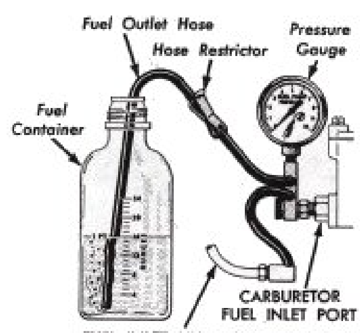


FIG. 1–Fuel Pump Pressure and Capacity Tests–Typical

and the pump and lines are in satisfactory condition, a vacuum test is not required.

If the pump volume is low, but the pressure is within specifications, a test must be made with the filter removed. If the pump volume meets specifications with the filter removed, replace the filter. If the pump volume is still below specifications, repeat the test, using an auxiliary fuel supply. If the pump still does not meet specifications, replace the pump. If the pump does meet specifications, there is a restriction in the fuel supply from the tank or the tank is not venting properly.

The tests are performed with the fuel pump installed on the engine. **Make certain the replaceable fuel filter element has been changed within the recommended maintenance mileage interval.** When in doubt, install a new filter prior to performing the tests. A clogged or restricted filter is often the cause of fuel system malfunction.

PRESSURE TEST

1. Remove the carburetor air cleaner. Disconnect the fuel inlet line at the carburetor. **Use care to**

prevent combustion due to fuel spillage.

2. Connect a pressure gauge, petcock and flexible hose (Fig. 1) between the carburetor inlet connector and the fuel inlet line connector.

3. Position the flexible hose restrictor so that the fuel can be expelled into a suitable container (Fig. 1) for the capacity (volume) test.

4. Operate the engine. Vent the system into the container by opening the hose restrictor momentarily before taking a pressure reading.

5. Operate the engine at 500 rpm. After the pressure has stabilized, it should be to specification.

CAPACITY VOLUME TEST

Perform this test only when the fuel pump pressure is within specifications.

1. Operate the engine at 500 rpm.
2. Open the hose restrictor and expel the fuel into the container (Fig. 1), while observing the time required to expel one pint; then close the restrictor. One pint of fuel should be expelled within the specified time limit.
3. Remove the test equipment, and connect the fuel inlet line to the carburetor.

FUEL PUMP, TANK AND LINES DIAGNOSIS GUIDE

LOW FUEL PUMP PRESSURE OR VOLUME	Diaphragm stretched or leaking. Fuel pump springs weak. Rocker arm or eccentric worn or undersize. Excessive clearance between rocker arm and fuel pump link. Fittings loose or cracked. Fuel filter clogged.	Fuel line cracked or broken. Fuel pump valves improperly seating. Dirt in fuel tank and/or lines. Fuel tank vent restricted. Diaphragm ruptured. Main body retaining screws loose.
HIGH FUEL PUMP PRESSURE OR VOLUME	Diaphragm spring too strong or improper spring. Diaphragm surface too tight (over-tensioned).	Pump link has no free play (frozen).
LOW FUEL PUMP VACUUM	Diaphragm stretched or leaking. Fuel pump springs weak. Fuel pump valves improperly seating. Diaphragm ruptured.	Rocker arm or eccentric worn. Excessive clearance between rocker arm and fuel pump link. Main body retaining screws loose.
LOW FUEL PUMP VOLUME WITH NORMAL PRESSURE	Fuel filter clogged. Fuel pump to carburetor inlet line obstructed, crimped or leaks.	Restriction in fuel supply line to fuel pump.
FUEL PUMP LEAKS FUEL	Main body retaining screws loose. Diaphragm defective. Fittings loose.	Threads on fittings stripped. Body cracked.
FUEL PUMP LEAKS OIL	Fuel pump retaining bolts loose.	Mounting gasket defective.
FUEL PUMP NOISE	Rocker arm or eccentric worn. Mounting bolts loose.	Rocker arm springs weak or broken.
FUEL TANK AND/OR INLET LINE HOSES COLLAPSED	Fuel tank vent cap obstructed.	

CARBURETOR

Dirt accumulation in the fuel and air passages, improper idle adjustments, and improper fuel level are the major sources of carburetor troubles.

TESTS

Accelerating Pump Discharge

1. Remove the air cleaner.
2. Open the primary throttle plates and observe the fuel flow from the accelerating pump discharge nozzle. If the system is operating correctly, a quick, steady stream of fuel will flow from the discharge nozzles.

Power Valve

A power valve must not be replaced unless it is leaking sufficiently to cause an unadjustable rough engine idle condition. Leakage in the power valve area can be caused by an improperly tightened cover or defective gaskets. Any defect in the gasket sealing qualities must be corrected before the power valve is replaced.

Power valve leakage that causes an unadjustable rough engine idle condition can be diagnosed, in most instances, by the fact that the idle mixture needle(s) must be nearly, or completely seated in order to obtain

a relatively smooth engine idle condition. If power valve leakage is suspected, the following test procedure must be performed.

1. Remove the carburetor from the intake manifold. Invert the carburetor.

2. Remove the glass bowl from the fixture (Fig. 2). Fill the bowl half-full of water. Install the bowl on the fixture.

3. Connect a line from the vacuum pump to the fitting on top of the fixture. Insert the large OD end of the wand into the tube and attach the other end of the tube to the fitting on the side of the fixture. Slip the rubber gasket (furnished with the tool) over the small OD end of the wand. Hold this end against the power valve vacuum pick-up port (Fig. 2).

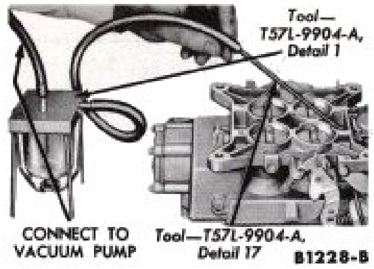


FIG. 2—Typical Ford 4-Barrel Carburetor Power Valve Test

4. Look for bubble formations in the water in the bowl. A continuous stream of bubbles indicates leakage through the power valve diaphragm or gasket, or the cover or gasket.

If leakage is encountered, the power valve, power valve gasket, the cover, and cover gasket should be replaced one at a time with a new part and the test repeated until the source of leakage has been found. If the source of leakage can not be found, the gasket seats are damaged and the defective parts should be replaced.

A few bubbles may be noticed immediately upon attaching the vacuum line. The bubbling should stop within approximately 15 seconds or after the air has been removed from the system. If no bubbles are seen, the power valve, gaskets and cover are sealing properly.

CARBURETOR DIAGNOSIS GUIDE

FLOODING OR LEAKING CARBURETOR	Cracked carburetor body. Defective main body and/or fuel bowl gasket. High fuel level or float setting. Fuel inlet needle not seating properly or worn needle and/or seat.	Ruptured accelerating pump diaphragm. Excessive fuel pump pressure. Defective power valve gasket. Ruptured power valve diaphragm.
HARD STARTING	Improper starting procedure causing a flooded engine. Improper carburetor fuel level. Improper idle adjustments. Sticking or incorrectly seating fuel inlet needle. Incorrect fuel pump pressure. Improper carburetor gasket and spacer combination.	Incorrect setting of choke thermostatic spring housing. Choke linkage or plate binding. Binding or broken manual choke linkage. Restrictions or air leaks in the choke vacuum or hot air passages. Dirty air cleaner element.
STALLING (ENGINE HOT OR COLD)	Incorrect idle fuel mixture. Engine idle speed too slow (fast or cold idle adjustments.). Dirt, water or ice in fuel filter. Positive crankcase ventilation system malfunctioning. Fuel lines restricted or leaking air. Fuel tank vent restricted. Leaking intake manifold or carburetor gaskets. Carburetor icing (cold, wet or humid weather).	Incorrect throttle linkage adjustment to carburetor. Clogged air bleeds or idle passages. Defective fuel pump. **Hot Only:** Improperly adjusted or defective carburetor dashpot. Idle compensator malfunctioning (if so equipped). Coolant control thermostat defective. Excessive looseness of throttle shaft in bore(s) of throttle body.
ROUGH IDLE	Positive crankcase ventilation system malfunctioning. Incorrect idle mixture adjustment. Idle compensator malfunction (if so equipped). Idle adjusting needle(s) grooved, worn, or otherwise damaged. Idle air bleeds restricted.	Idle air or fuel passages restricted. Idle discharge holes restricted. Idle discharge holes not in proper relation to throttle plate(s). Excessive dirt in air cleaner. High or low fuel level or float setting. Fuel inlet needle not seating prop-

CONTINUED ON NEXT PAGE

CARBURETOR DIAGNOSIS GUIDE—Continued

ROUGH IDLE—Continued	erly, or worn needle or seat. Power valve leaking. Restricted air bleeds. Plugged idle fuel channel restrictor. Worn or damaged main metering jet. Accelerating pump discharge ball	check and/or weight not seating properly. Fuel pump pressure too low, or excessive. Fuel siphoning from secondary main fuel system (Ford 4-Barrel). Restriction in main fuel passage.
POOR ACCELERATION	Poor acceleration complaints fall under one of three headings: the engine is sluggish on acceleration, the engine stalls when accelerated, or the engine hesitates or develops a	flat spot when accelerated. Poor acceleration is caused by either an excessively lean or rich mixture on acceleration.
A LEAN MIXTURE ON ACCELERATION	Low fuel pump pressure. Sticking fuel inlet needle. Low fuel level or float setting. Restriction in main fuel passage. Air leak between the carburetor and the manifold caused by loose mounting bolts or defective gasket. Air leak at the throttle shaft caused by a worn throttle shaft. Accelerating pump diaphragm defective. Incorrect accelerating pump stroke adjustment. Accelerating pump fuel inlet valve not seating on acceleration. Restriction in the accelerating pump discharge passage. Accelerating pump discharge ball check or weight not coming fully off its seat, or failing to seat properly on the reverse stroke of the pump diaphragm.	Air leak at the accelerating pump cover caused by a defective gasket or warped pump cover. Defective secondary diaphragm. Air leak where secondary vacuum pick-up tube fits into air horn, between air horn and main body, or between the secondary diaphragm housing cover and housing. Secondary throttle plates wedged in barrels. Bent secondary throttle shaft. Secondary throttle plates operating rod binding, or disconnected from secondary diaphragm or secondary throttle lever. Secondary vacuum passage ball check stuck on its seat. Secondary vacuum probe restricted or not properly positioned. Weak power valve spring.
A RICH MIXTURE ON ACCELERATION	Excessive fuel pump pressure. High fuel level or float setting. Fuel inlet needle not seating properly or worn needle and/or seat. Malfunctioning automatic choke. Excessive dirty air cleaner. Incorrect accelerating pump stroke	adjustment. Power valve leakage. Restricted air bleeds. Worn or damaged main metering jet. Accelating pump ball check and/or weight not seating properly.
INCONSISTENT ENGINE IDLE SPEED	Fast idle screw contacting low step of cam at curb idle. Incorrect throttle linkage adjustment to carburetor. Binding or sticking throttle linkage or accelerator pedal. Sticking carburetor throttle shaft. Excessive looseness of throttle shaft in bores of throttle body.	Improperly adjusted or defective carburetor dashpot. Incorrectly installed throttle plates. Idle compensator malfunctioning (if so equipped). Positive crankcase ventilation system malfunctioning. Sticking fuel inlet needle. Defective spark valve or gasket (144, 170 and 200 Six only).
AUTOMATIC CHOKE SLOW WARM-UP, ON TOO OFTEN	Thermostatic choke setting too rich. Choke linkage sticking or binding. Incorrect choke linkage adjustment. Choke plate misaligned or binding	in air horn. Defective coolant thermostat. Restricted coolant line at carburetor Restriction or air leak in the choke vacuum or hot air passage.

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CARBURETOR DIAGNOSIS GUIDE—Continued

SEVERE TRANSMISSION ENGAGEMENT AFTER COLD ENGINE START	Carburetor fast idle speed setting too high. Throttle operating on starting step	(highest step) of the fast idle cam. Binding or sticking throttle linkage or accelerator pedal.
SURGING (CRUISING SPEEDS TO TOP SPEEDS)	Clogged main jets. Improper size main jets. Low fuel level or float setting. Low fuel pump pressure volume. Clogged filter screen.	Distributor vacuum passage clogged. Defective spark valve or gasket (144, 170 and 200 Six only).
REDUCED TOP SPEED	Float setting too high or too low. Fuel pump pressure or volume too high or too low. Improper size or obstructed main jets. Faulty choke operation. Improper throttle linkage adjustment. Air leak where secondary vacuum pick-up tube fits into air horn and main body, or between the secondary	diaphragm housing cover and housing. Secondary diaphragm return spring too stiff. Secondary throttle plates wedged in barrels. Bent secondary throttle shaft. Secondary throttle plate operating rod binding. Secondary vacuum passage ball check sticking on its seat.

AIR INTAKE DUCT

Proper operation of the air intake duct thermostatic valve, as used on the 260 and 289 V-8 engine, can be determined by the following test:

1. Place the air duct assembly in a container of cool water (below 75°F.). Be sure that the thermostat is covered by the water.

2. Place the thermometer in the water and observe the temperature.

3. With water temperature at 75°F. or below, the valve should be in the heat-on position.

4. Using a hot plate or other suitable device, heat the water slowly.

5. When the water temperature reaches 85°F., the valve should start to open. **If the valve does not start to open at this time, stabilize the water temperature at 85°F. for eight minutes before condemning the unit.**

6. When the water temperature reaches 100°F. or higher, the valve should be in the full heat-off position.

7. If the operation of the valve is unsatisfactory, remove the thermostat and spring assembly and check the valve plate shaft for binding.

8. **If the valve plate moves freely,** replace the thermostat and spring assembly. Retest the heat-on and the heat-off temperatures.

9. If the valve does not operate correctly, adjust the thermostat rod. By increasing the rod length, the valve plate will be moved toward the heat-off position. By decreasing the rod length the valve plate will be moved toward the heat-on position.

2 COMMON ADJUSTMENTS AND REPAIRS

FORD SINGLE-BARREL CARBURETOR BENCH ADJUSTMENTS

The automatic choke fast idle speed and automatic choke linkage (pull-down) adjustments of the Comet carburetor must be performed only as bench adjustments.

The carburetor float level, accelerating pump, anti-stall dashpot, vent valve, manual choke, automatic choke thermostatic cover, initial idle mixture and initial curb idle speed adjustments can be performed with the carburetor on the bench or in the car. Refer to "In-Car Adjustments and Repairs" in Part 10-2 for the proper procedures.

AUTOMATIC CHOKE FAST IDLE ADJUSTMENTS

Insert a gauge pin or drill of the same thickness as the specified clearance between the throttle plate and the side of the throttle bore. Hold the throttle plate against the gauge pin or drill (Fig. 3). Close the choke plate and turn the fast idle screw inward until it just contacts the fast idle cam.

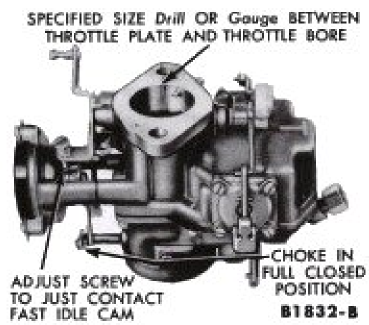

FIG. 3—Automatic Choke Fast Idle Adjustment

AUTOMATIC CHOKE LINKAGE (PULLDOWN) ADJUSTMENT

The "Automatic Choke Fast Idle Adjustment" must be set before performing the choke pulldown adjustment, because the position of the pulldown rod is one of the determining factors affecting the throttle to choke opening relationship.

1. Place a drill or gauge of the same thickness as the specified clearance between the choke plate and the upper body bore wall. Close the choke plate on the drill or gauge and hold it securely (Fig. 4).

2. Close the throttle until the fast idle screw touches the fast idle cam. Adjust the plastic nut to just contact the swivel on the choke lever assembly.

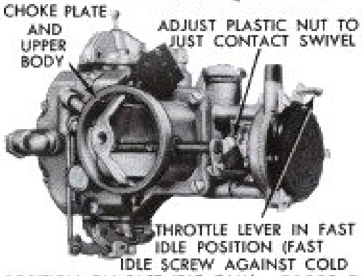

FIG. 4—Automatic Choke Linkage Adjustment

FORD DUAL AND 4-BARREL CARBURETOR BENCH ADJUSTMENTS

The fuel level float adjustment (dry) and the secondary throttle plate adjustments (4-barrel carburetor) are performed only as bench adjustments.

The automatic choke plate clearance (pull-down) adjustment, automatic choke magnet and bracket adjustment (if so equipped) automatic choke housing adjustment, and the accelerating pump stroke adjustment can be performed with the carburetor on the bench or in the car. Refer to "In-Car Adjustments and Repairs" in Part 10-3, for the Ford Dual Carburetor adjustment procedures or refer to "In-Car Adjustments and Repairs" Part 10-4, for the Ford 4-Barrel procedures.

FLOAT ADJUSTMENT (DRY)—FORD DUAL AND 4-BARREL CARBURETORS

The dry float fuel level adjustment is a preliminary adjustment only. The final fuel level (wet) adjustment must be performed after

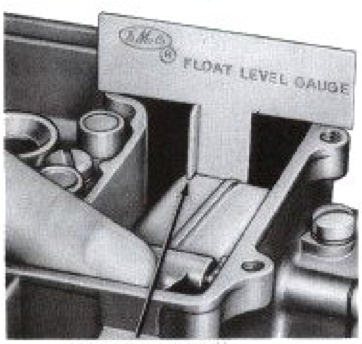

FIG. 5—Typical Fuel Level Float Adjustment—Dry

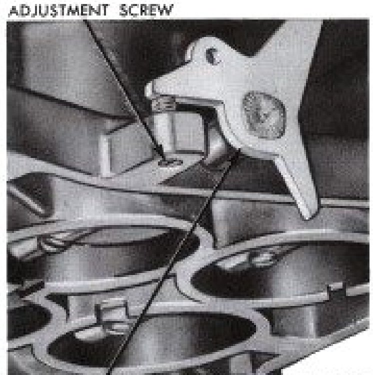

FIG. 6—Secondary Throttle Plate Adjustment

the carburetor is mounted on the engine, as follows:

1. Remove the air horn.

2 With the float raised and the fuel inlet needle seated, check the distance between the top surface of the main body and the top surface of the float for conformance to specifications. Take this measurement at a point ⅛ inch from the free end of the float and $\frac{5}{16}$ inch in from the side of the float adjacent to the inside wall of the fuel bowl. If the cardboard gauge is used, place the float gauge in the corner of the enlarged end section of the fuel bowl (Fig. 5). The gauge should touch the float near the end, but not on the end radius. Depress the float tab to seat the fuel inlet needle. The float height is measured from the gasket surface of the main body with the gasket removed. If necessary, bend the tab on the float to bring the setting within the specified limits. This should provide the proper fuel level.

SECONDARY THROTTLE PLATE ADJUSTMENT—4-BARREL CARBURETOR

1. Hold the secondary throttle plates closed.

2. Turn the secondary throttle shaft lever adjusting screw out (counterclockwise) until the secondary throttle plates stick in the throttle bores (Fig. 6).

3. Turn the screw in (clockwise) until the screw just contacts the secondary lever.

4. Finally, turn the screw ¾ turn clockwise for the correct setting.

FUEL FILTER REPLACEMENT

The fuel filters are integrally mounted on the fuel pump.

Replace the filter element (Fig. 7) if it becomes clogged, and also at the recommended maintenance mileage interval.

MAINTENANCE

Refer to Group 19 for the recommended maintenance mileage interval.

FILTER REPLACEMENT

1. Unscrew the filter housing from the fuel pump. Remove the filter element and gasket. Discard the element and gasket. Clean the filter housing in cleaning solvent.

2. Place a new filter element over the spout in the fuel pump valve housing cover (Fig. 7). Coat a new gasket with light engine oil and position the gasket on the filter housing. Screw the filter housing on the fuel pump. Hand-tighten the filter housing until the gasket contacts the pump, then advance it ⅛ turn.

3. Start the engine and check for leaks.

AIR INTAKE DUCT ADJUSTMENT

The air intake duct thermostatic valve, is used on the 260 and 289 V-8 Engine, can be adjusted to change the air temperature at which the valve opens. Increasing the thermostatic rod length will move the valve toward the heat-off position. Decreasing the rod length will move the valve toward the heat-on position. Adjustments must be verified by testing the opening temperature as detailed in Section 1.

FIG. 7—Typical Integral Fuel Filter Assembly

3 CLEANING AND INSPECTION

CARBURETOR

Dirt, gum, water or carbon contamination in the carburetor or the exterior moving parts of the carburetor are often responsible for unsatisfactory performance. For this reason, efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection of only those parts not included in the carburetor overhaul repair kit are covered here. All gaskets and parts included in the repair kit should be installed when the carburetor is assembled and the old gaskets and parts should be discarded.

Wash all the carburetor parts (except the accelerating pump diaphragm, the power valve or power valve diaphragm, the secondary operating diaphragm, and the anti-stall dashpot assembly) in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, laquer thinner or denatured alcohol may be used.

Rinse the parts in kerosene to remove all traces of the cleaning solvent, then dry them with compressed air. Wipe all parts that can not be immersed in solvent with a clean, soft, dry cloth. Be sure all dirt, gum, carbon, and other foreign matter are removed from all parts.

Force compressed air through all passages of the carburetor. **Do not use a wire brush to clean any parts or a drill or wire to clean out any openings or passages in the carburetor.** A drill or wire may enlarge the hole or passage, changing the calibration of the carburetor.

Check the choke shaft for grooves, wear, and excessive looseness or binding. Inspect the choke plate for nicked edges and for ease of operation and free it if necessary.

Check the throttle shafts in their bores for excessive looseness or binding and check the throttle plates for burrs which prevent proper closure.

Inspect the main body, air horn, nozzle bars and booster venturi assemblies, choke housing and thermostatic spring housing, power valve cover, accelerating pump cover, secondary operating diaphragm cover and the main body for cracks.

Check the floats for leaks by holding them under water that has been heated to just below the boiling point. Bubbles will appear if there is a leak. If a float leaks, replace it. Replace the float if the arm needle contact surface is grooved. If the floats are serviceable, polish the needle contact surface of the arm. Replace the float shafts if they are worn.

Replace all screws and nuts that have stripped threads. Replace all distorted or broken springs.

Inspect all gasket mating surfaces for nicks and burrs. Repair or replace any parts that have a damaged gasket surface.

Inspect the idle tubes in each nozzle bar assembly. If they are plugged, bent, or broken, replace the booster venturi and nozzle bar assembly.

Inspect the rubber boot of the anti-stall dashpot for proper installation in the groove of the stem bushing. Check the stem movement for smooth operation. Do not lubricate the stem. Replace the assembly if it is defective.

FUEL PUMP

Clean the fuel pump body, valve housing, cover, and filter housing in solvent. Blow out all body, housing, and cover passages. Inspect the pump body, valve housing, and cover for cracks or damage and replace them if necessary. If the fuel valves are not serviceable and replacement is necessary, replace the valve housing and valves as an assembly. Inspect the mounting flange for distortion. Remove the pump body or lap the distorted flange if necessary.

AIR CLEANER

MAINTENANCE

Refer to Group 19 for the recommended air cleaner assembly maintenance mileage interval.

REMOVAL AND INSTALLATION

Refer to Part 10-5, Section 2 for the air cleaner assembly removal and installation procedures.

FILTER ELEMENT

The filter element must never be cleaned with a solvent or cleaning solution. Also, oil must not be added to the surfaces of the filter element or air cleaner body.

There are two alternate procedures that can be used to clean the air filter element. One method is performed with the use of compressed air. The other is performed by tapping the element on a smooth horizontal surface.

Compressed Air Method Direct a stream of compressed air through the element in the direction opposite that of the intake air flow, that is from the inside outward. **Extreme care must be exercised to prevent rupture of the element material.**

Tapping Method. Hold the element in a vertical position and tap it lightly against a smooth, horizontal surface to shake the dust and dirt out. **Do not deform the element or damage the gasket surfaces by tapping too hard.** Rotate the filter after each tap until the entire outer surface has been cleaned.

Inspection. Hold the filter in front of a back-up light and carefully inspect it for any splits or cracks. If the filter is split or cracked, replace it.

BODY AND COVER

Clean the air cleaner body and the cover with a solvent or compressed air. Wipe the air cleaner dry if a solvent is used. Inspect the air cleaner body and cover for distortion or damage at the gasket mating surfaces. Replace the cover or body if they are damaged beyond repair.

PART 10-2 FORD SINGLE-BARREL CARBURETOR

1 DESCRIPTION AND OPERATION

DESCRIPTION

The carburetor (Figs. 1 and 2) consists of two main assemblies, the main (upper) body and the throttle (lower) body.

The upper body assembly contains the major metering components of the carburetor: the main and idle fuel system, the power valve, float chamber vent, and the fuel inlet system.

The lower body assembly contains: the fuel bowl, the accelerating pump assembly, the idle mixture adjusting screw, and the spark valve. A hydraulic dashpot is also included in the lower body for use on car models that are equipped with an automatic transmission.

A manual choke is standard equipment on Falcon models, and an automatic choke is standard on Comet models.

This section applies to all carburetors. Differences in carburetor operation are given when they exist.

OPERATION

The engine speed is regulated and controlled by the proportion of fuel and air delivered to the cylinders for all engine operating conditions. Operation is based on the principle of pressure differences or "vacuum".

Air is drawn into the carburetor air horn by manifold vacuum. As the air passes through the carburetor on its way to enter the cylinders, lower pressure is created at the fuel discharge outlets of the carburetor. The fuel bowl is vented to atmospheric and to carburetor air inlet pressure through a vent hole in the upper body assembly. The higher air pressure exerted on the fuel in the bowl forces the fuel to travel up through the fuel discharge channels and out into the air stream passing through the carburetor. The fuel and air is mixed at this point and distributed into the engine cylinders for burning.

FUEL INLET SYSTEM

The fuel inlet system (Fig. 2) of the carburetor maintains a predetermined fuel level in the fuel bowl. **The fuel level in the bowl is extremely important to carburetor calibration.** If the level of the fuel in the bowl is below the specified setting, a lean fuel-air mixture will result. A rich fuel-air mixture will occur from a higher than specified fuel level. The entire calibration of the carburetor is disturbed if the fuel level is not set as specified.

Fuel enters the fuel bowl through the fuel needle valve and seat assembly. The amount of fuel entering is regulated by the distance the needle valve is moved off the seat and by fuel pump pressure. **Correct fuel pump pressure is important if the carburetor fuel level is to be maintained within the specified limits.**

The fuel level is maintained at a predetermined level by the float and lever assembly which controls the movement of the needle valve. The needle valve, riding on the tab of the float and lever assembly, reacts to any change in height of the float and the fuel level.

IDLE FUEL MIXTURE

The idle system (Fig. 4) functions when the engine is operating at low rpm. It supplies the fuel-air mixture when the air flow past the carburetor venturi is insufficient to operate the main metering system.

The range of the idle system will extend into the operation of the main metering system. Fuel will flow from the main well up the idle well and through the calibrated idle jet. Filtered air from the carburetor air horn enters the idle air bleed restriction and mixes with the fuel. The air bleed restriction also serves as a vent to prevent syphoning of fuel at high speeds or when the engine is shut off. The fuel-air mixture then passes down through an idle channel restriction and is transferred to the idle channel in the lower body assembly.

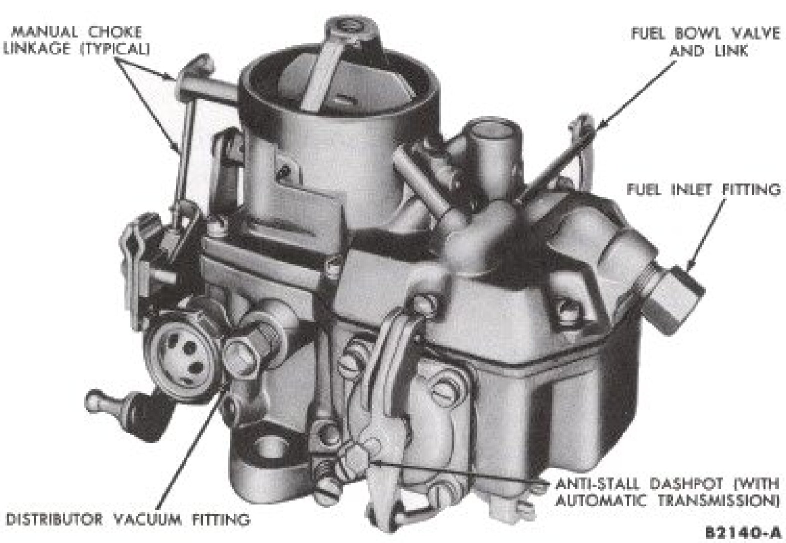

FIG. 1—Ford Single-Barrel Carburetor—Manual Choke

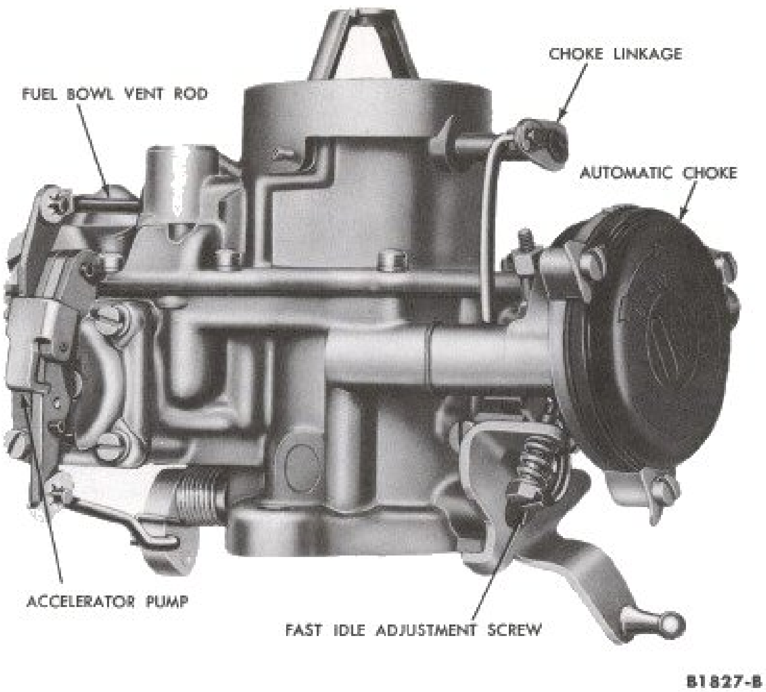

FIG. 2—Ford Single-Barrel Carburetor—Automatic Choke

The fuel air mixture passes down the idle channel, past two idle transfer holes, to the idle mixture adjusting screw. The idle transfer holes act as additional air bleeds at normal idle. The fuel air mixture flows past the idle adjusting screw needle and seat and is discharged below the throttle plate. The amount of mixture to be discharged is determined by the position of the idle screw needle in relation to the seat in the lower body passage.

During off-idle operation, when the throttle plate is moved past the idle transfer holes, each hole begins discharging fuel as it is exposed to the lower air pressure (manifold vacuum). Continued opening of the throttle plate increases engine rpm and air flow through the carburetor. The greater air flow past the booster venturi causes a pressure drop in the venturi great enough to bring the main fuel metering system into operation as the idle fuel metering system tapers off.

MAIN FUEL METERING SYSTEM

The main fuel metering system (Fig. 5) supplies the fuel required for engine operation during the cruise or part-throttle range. The system begins the function when the air flow through the carburetor venturi creates a sufficient vacuum to start fuel flowing in the main system. The vacuum at the discharge nozzle will increase as the air flow increases. The faster the engine operates, the more fuel will flow through the main fuel system.

Fuel entering the main jet, located at the bottom of the main well, flows up toward the main nozzle. A main well tube is inserted within the main well. Air from the high speed bleed channel enters the main well tube through a calibrated restriction at the top of the tube. The air passes through holes spaced along the tube,

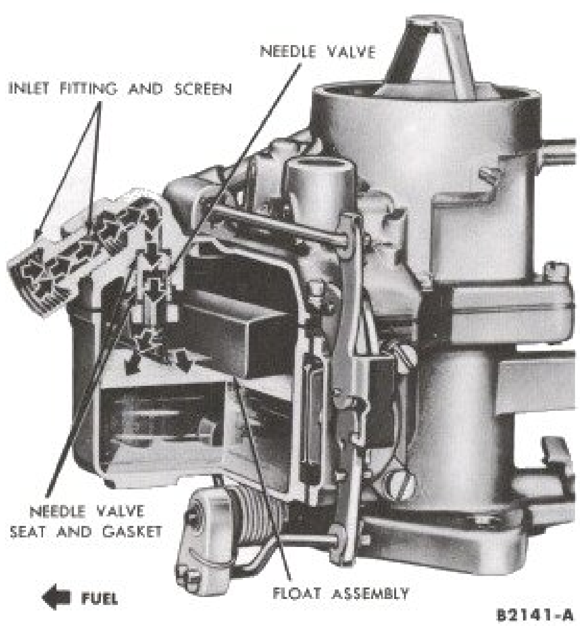

FIG. 3—Fuel Inlet System

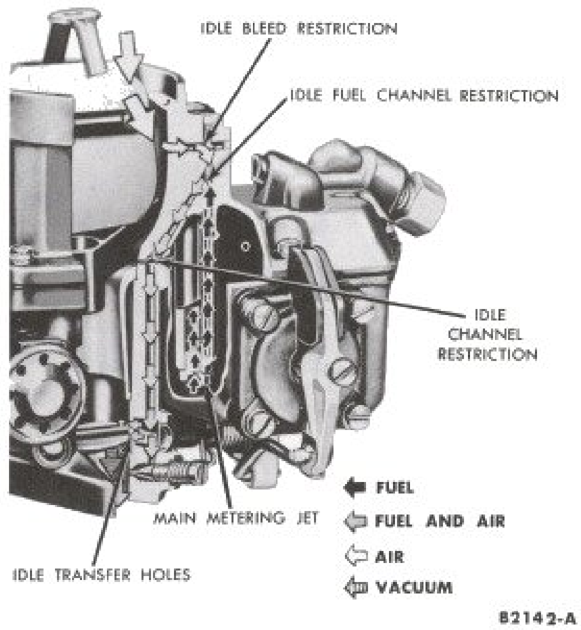

FIG. 4—Idle Fuel System

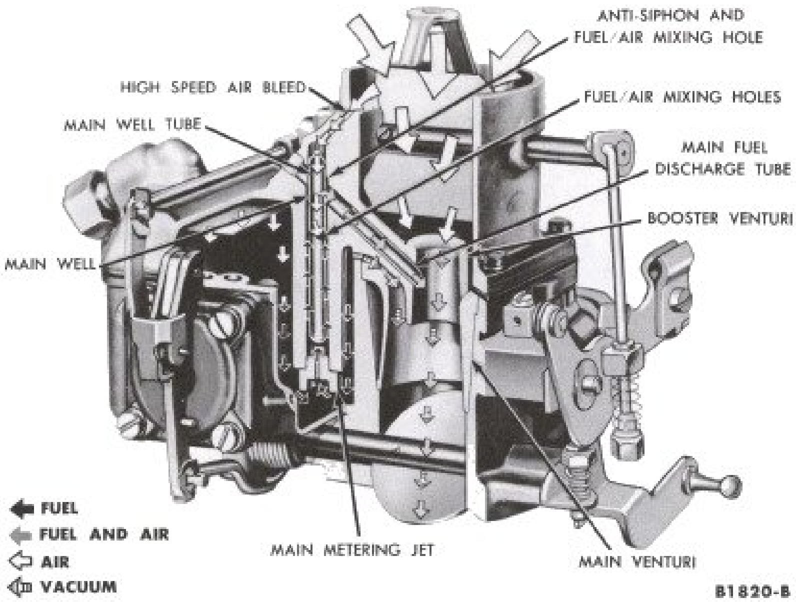

FIG. 5—Main Metering System

mixing with the fuel flowing up the main well. The fuel and air mixture being lighter than solid fuel, responds faster to changes in venturi pressures. The mixture continues flowing up the main well to the anti-syphon bleed. More air is introduced at the anti-syphon bleed to the fuel and air mixture which is then discharged from the main nozzle. The fuel is mixed with the filtered air moving past and through the booster venturi.

The anti-syphon bleed also acts as a vent to prevent syphoning of fuel at low engine speeds.

ACCELERATING PUMP SYSTEM

Smooth acceleration requires a momentary increase in the supply of fuel. The air flow through the carburetor responds almost immediately to any increase in carburetor throttle valve opening. The fuel within the metering passages will lag momentarily in its response to the pressure difference created by this increased air flow. This lag in fuel response will cause a temporary leanness in the fuel-air mixture that results in a hesitation in engine acceleration. A mechanically operated accelerating pump system (Fig. 6) supplies added fuel to provide a richer fuel-air mixture for this brief period of time.

The accelerating pump, located on the side of the lower body assembly, is actuated by linkage connected to the throttle shaft. When the throttle is opened on acceleration, the diaphragm forces fuel from the accelerating pump chamber into the discharge channel. The inlet ball check closes to prevent a reverse flow of fuel. Fuel under pressure forces the discharge ball check and the weight off its seat, allowing fuel to pass up to the discharge nozzle. The fuel is sprayed from the nozzle into the air stream above the main venturi.

When the throttle plate is closed on deceleration, a return spring forces the diaphragm back, drawing fuel through the inlet channel. The inlet ball check opens, allowing fuel to pass into the chamber while the discharge ball check closes preventing entry of air. A bleed hole is located in the body casting to allow vapor and excess pressure to escape from the diaphragm chamber.

POWER FUEL SYSTEM

When the engine is required to deliver more power to meet an increased road load demand or wide-open throttle operation, the carburetor must deliver a richer fuel-air mixture than supplied during the operation of the main fuel system at cruise or part throttle operation. When the engine is running under a high power demand, intake manifold vacuum is low. The vacuum below the carburetor throttle plate approximates intake manifold vacuum. The carburetor power valve (Fig. 6) will open when the manifold vacuum drops below a predetermined value. The fuel-air mixture is thus automatically enriched to meet the increased engine power demands.

Manifold vacuum is transmitted from an opening below the throttle plate through a channel to the upper body assembly and to the top of the power valve piston. At idle and normal engine speeds, the manifold vacuum is great enough to hold the power valve piston up.

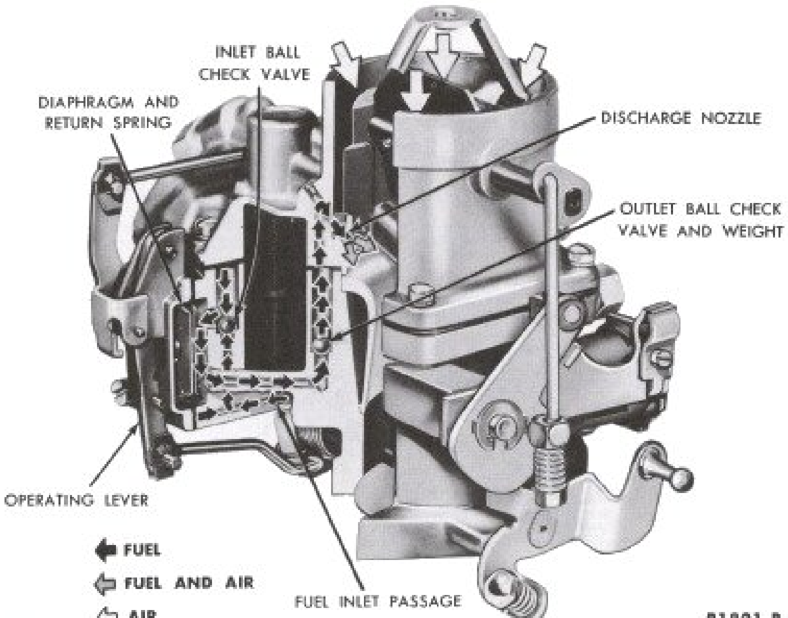

FIG. 6—Accelerating Pump System

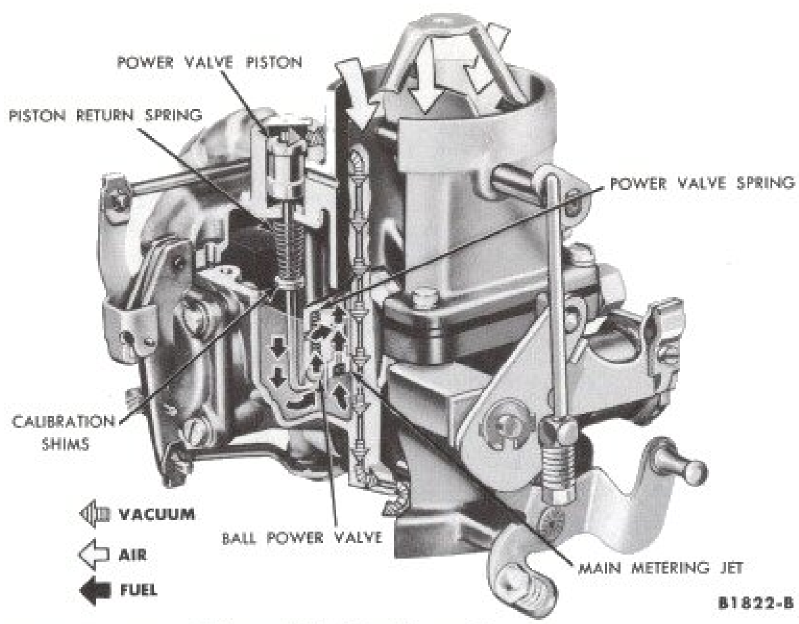

FIG. 7—Power Valve and Fuel Enrichment System

The power valve rod is connected to the piston. The foot of the rod controls the spring-loaded power valve ball check. With the piston held up by manifold vacuum, the ball check closes the power jet inlet channel.

A power valve spring is located on the rod. The spring is shim calibrated to overcome the vacuum above the piston when manifold vacuum drops below a predetermined level. Upon demand for more power, the manifold vacuum drops below this level. The spring tension moves the rod down and allows the power valve ball check to open. Air pressure above the fuel bowl forces fuel to flow through the power jet, adding to fuel in the main fuel system, enriching the fuel-air mixture.

As the demand for power decreases and manifold vacuum increases, the vacuum above the piston overcomes the spring tension. The piston and rod move up and the ball check closes the power jet channel.

MANUAL CHOKE SYSTEM

The choke plate, located in the air horn above the venturi, when closed provides a high vacuum above as well as below the throttle plate. With a vacuum above the throttle plate, fuel will flow from the main fuel system as well as from the idle fuel system. This provides the extremely rich mixture necessary for cold engine operation.

A rod connects the choke cam and lever to the choke shaft through a spring and a spring tension adjusting nut.

When the choke cam and lever is pulled to a full choke position by the choke cable, the pull-down rod actuates the choke plate through the spring and adjusting nut.

As soon as the engine starts, engine vacuum will partially open the choke plate against pull-down spring tension (the distance present after the initial choke pull-down adjustment) to prevent flooding and engine stalling.

During cold engine starting and the engine warm-up period, the choke plate must be adjusted manually through the choke cable to control the fuel richness for satisfactory engine operation. The choke cable is pushed in as choking requirements are reduced. The choke system is not required after the engine reaches normal operating temperatures and the fuel-air mixture must be returned to normal.

The idle adjusting screw bears against the bottom of the choke cam and lever during idle or closed throttle conditions. The choke cam and lever opens the throttle slightly, through contact of the idle adjusting screw with the cam (when properly adjusted), as the manual choke position is selected. Higher engine idle speeds are automatically provided through contact of the idle adjusting screw with the cam.

AUTOMATIC CHOKE SYSTEM

The automatic choke system (Fig. 8) provides all the proper choking action required to enrich the fuel-air mixture during the engine warm up period. This is accomplished primarily through the use of a bimetal thermostatic coil spring. The automatic choke control assembly is mounted on the lower body assembly and linked to the choke shaft lever.

The bimetal thermostatic spring winds up when cold and unwinds when warm. When the engine is cold, the thermostatic spring, through attaching linkage, holds the choke plate in a closed position. A cold engine is started by opening the throttle fully to permit the pressure exerted by the bi-metal spring to close the choke plate when the engine is cold. A fast idle cam is also rotated into position by the automatic choke lever and through a torsion spring to contact the fast idle adjusting screw.

The throttle is returned to a partially opened position and the engine is cranked. When the engine starts running, the spring action of the bi-metal spring will permit partial opening of the choke plate. As the throttle is returned to the idle position, the pulldown rod opens the choke plate mechanically to a calibrated setting. The fast idle screw, attached to the throttle lever, increases the engine idle speed for smoother running when the engine is cold.

During driveaway, increased air flow will result in increased pressure on the choke plate, causing the choke plate to partially open against the force of the bi-metal spring, thereby controlling fuel-air mixture in response to engine demand.

As the engine continues to run, manifold vacuum, channeled through a passage on the bottom of the lower body to the choke housing, draws heated air from the exhaust manifold heat chamber. The amount of air entering the choke housing is controlled by restriction of air channels in the carburetor.

The warmed air from the heat chamber enters the choke housing and heats the thermostatic spring, causing it to warm up. The tension of the thermostatic spring gradually decreases as the temperature of the air from the heat chamber rises, allowing the choke plate to open. The air in the choke housing is ex-

hausted into the intake manifold. When the engine reaches its normal operating temperature, the spring exerts tension on the choke plate, forcing it to the full open position.

When the choke plate is partially or fully closed, a fast idle cam is rotated into position to contact the fast idle adjustment screw. The screw, attached to the throttle lever, permits a faster engine idle speed for smoother running when the engine is cold. The thermostatic choke lever and torsion spring rotate the fast idle cam to lower the engine idle speed when the engine temperature rises and choking is reduced.

The throttle lever and pulldown rod partially opens the choke plate when the accelerator pedal is fully depressed. This permits unloading a flooded engine.

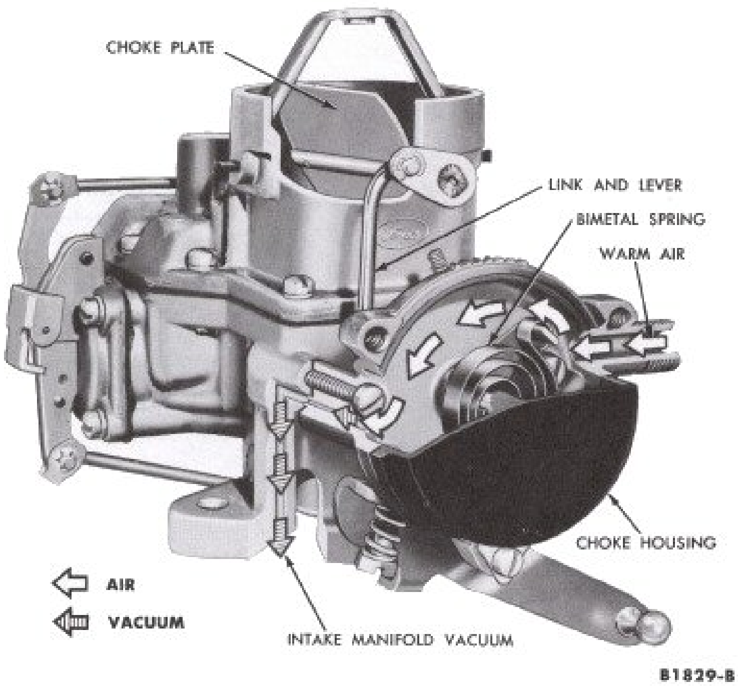

FIG. 8—Automatic Choke System

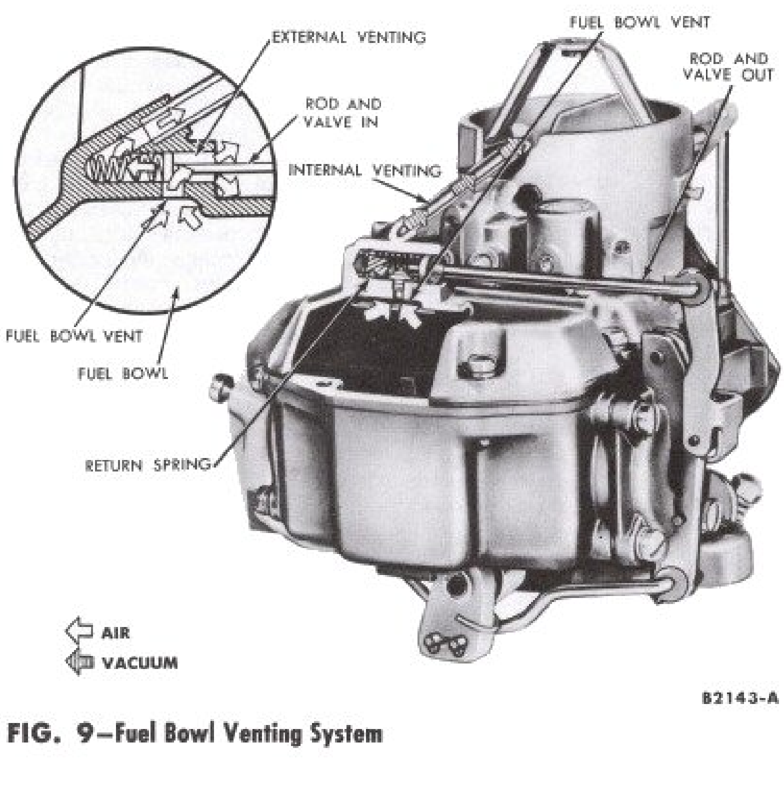

FIG. 9—Fuel Bowl Venting System

FUEL BOWL VENT SYSTEM

The fuel bowl requires venting (Fig. 9) to provide proper operation for the various systems. Fuel vapors may form in the fuel bowl when a hot engine is stopped, idling, or operating at very low speeds. By venting the fuel bowl to the atmosphere by means of a vent control valve, engine performance is improved. At higher engine speeds, venting to the carburetor air horn prevents calibration changes due to normal air cleaner contamination.

The restriction of air due to air cleaner contamination causes a pressure drop in the carburetor air horn, and a richer air-fuel mixture. The pressure drop will incease as the demand for air (engine speed) is increased.

On all carburetors a valve connected through linkage to the throttle shaft and located in a bore over the fuel bowl, is at the inward position during closed or part throttle operation. In this position, the valve allows venting only to the atmosphere.

At normal or wide-open throttle operation, the rod moves outward sealing the external vent and opening the vent to the carburetor throat.

SPARK (DISTRIBUTOR VACUUM) CONTROL SYSTEM

The degree of spark advance in the distributor is determined by the strength of the vacuum acting on the distributor diaphragm. A high vacuum will increase spark advance. The carburetor is calibrated to provide the required vacuum to the distributor through an interaction of venturi vacuum and manifold vacuum. Venturi vacuum is obtained through the pickup tube in the main venturi and is supplied to the distributor only when it exceeds manifold vacuum (Fig. 10).

Manifold vacuum supplied to the distributor, is obtained from a pickup hole at the throttle plate edge (when the throttle is closed) and metered to the distributor. An additional passage is always open to manifold vacuum. The purpose of the additional passage is to provide a higher spark advance at closed throttle during deceleration to promote complete burning of the fuel and greater efficiency. Metering of the manifold vacuum to the distributor is accomplished through the use of the spark valve and restrictors in the vacuum channels. The spark valve is held open through the combination of vacuum and atmospheric pressure acting on the spark valve diaphragm to overcome the tension of a calibrated spring in the spark valve. Calibrated restrictors in the manifold vacuum channels limit the flow of manifold vacuum to the distributor. Also, during low manifold vacuum periods, the bypass restrictor controls the reduction of venturi vacuum caused by bleed back.

At off-idle engine speeds, vacuum at the throttle edge is high due to a venturi effect created by the position of the throttle plate in the throttle bore. The high vacuum in his area is supplied to the distributor through the manifold vacuum channels for the required increase in spark advance.

Upon acceleration and under wide-open throttle operation, manifold vacuum drops. When the manifold vacuum falls below a predetermined point, the spark valve closes, shutting off the manifold vacuum to the distributor. The drop in distributor vacuum retards the spark advance. Venturi vacuum, now greater than manifold vacuum, supplies vacuum to the distributor, thus preventing a full spark retard.

As the engine load demands decrease, the increase in manifold vacuum will become greater than venturi vacuum. The increased manifold vacuum opens the spark valve and the higher vacuum now supplied to the distributor increases the spark advance for more efficient engine operation.

DASHPOT SYSTEM

The low idle rpm setting on automatic transmission equipped units requires a means of control to prevent engine stall upon sudden closing of the throttle plate. This is accomplished by hydraulic dampening of the throttle closing rate.

The dashpot, located on the side of the fuel bowl, is actuated by linkage connected to the throttle shaft (Fig. 11). When the throttle is opened a return spring forces the diaphragm back, drawing fuel through the inlet channel. The inlet ball check opens, allowing fuel to flow into the dashpot chamber.

When the throttle plate is closed, the dashpot actuating lever and adjusting screw moves the diaphragm inward. The diaphragm moving inward seats the inlet ball check, closes the inlet channel and forces fuel through a restriction into the fuel outlet channel into the bowl. The discharge restriction limits the flow of fuel and slows the closing of the throttle plate.

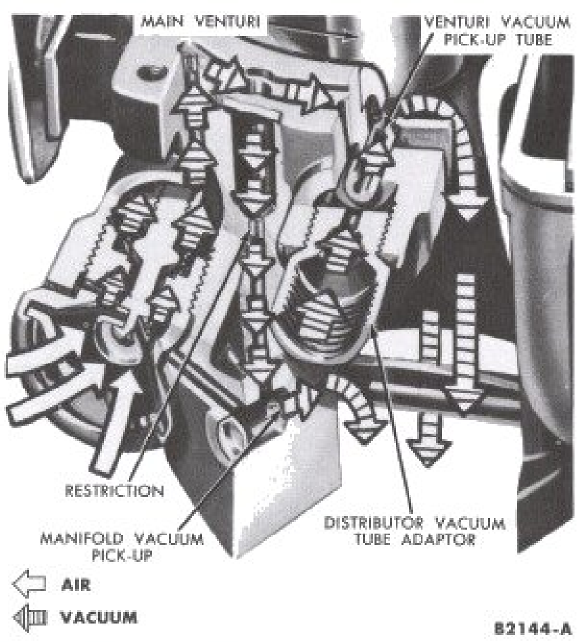

FIG. 10—Spark (Distributor Vacuum) Control System

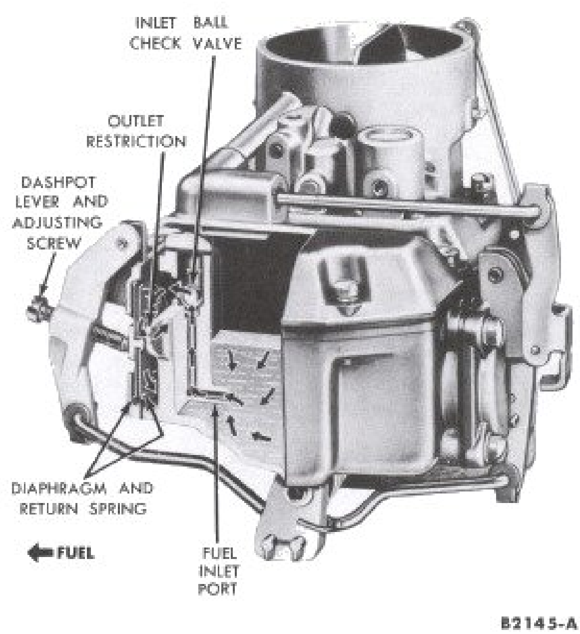

FIG. 11—Anti-Stall Dashpot

2 IN-CAR ADJUSTMENTS AND REPAIRS

The automatic choke fast idle speed and choke linkage (pull-down) adjustments on Comet can only be performed on the bench with the carburetor removed. Refer to Part 10-1 for the proper procedures.

The final idle speed and fuel mixture adjustments, and the throttle linkage adjustments can be performed only with the carburetor installed on the engine.

The procedures for adjusting the carburetor float, accelerating pump, anti-stall dashpot, vent valve, manual choke, initial idle mixture, and the initial curb idle speed can be performed with the carburetor on the bench or in the car.

IDLE FUEL MIXTURE AND IDLE SPEED ADJUSTMENTS

The engine idle speed is adjusted to settings for a hot engine and a cold engine (fast idle speed). Make the idle and fuel mixture adjustments in the sequence listed.

INITIAL IDLE MIXTURE SETTING

If necessary, initially set the idle mixture by turning the idle mixture screw inward (clockwise) until it is lightly seated (Fig. 12); then turn the screw outward (counterclockwise) the specified number of turns. **Do not turn the screw needle tightly against its seat as this may groove the end. If the needle is damaged, it must be replaced before a satisfactory fuel mixture can be obtained.**

INITIAL CURB IDLE ADJUSTMENT—MANUAL CHOKE

A stop screw at the throttle lever flange of the carburetor (Figs. 13 and 14) controls the engine idle speed. Turn the screw outward (counterclockwise) to increase the engine idle speed and inward (clockwise) to decrease the engine idle speed.

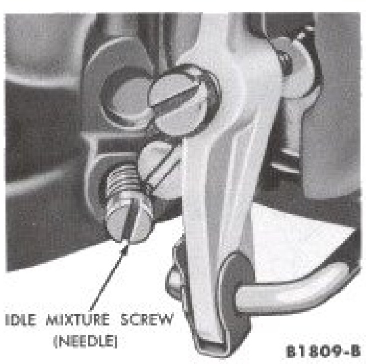

FIG. 12—Idle Fuel Mixture Adjustment

The initial curb idle adjustment will automatically set the initial fast idle rpm required.

Position the choke control lever so that the choke plate is fully open. Seat the throttle plate in the throttle bore. **It may be necessary to back off on the dashpot adjustment screw to seat the throttle plate in the throttle bore.** Set the idle adjusting screw (Figs. 13 and 14) to just make contact with the cam contour; then turn the screw outward (counterclockwise) an additional turn.

INITIAL CURB IDLE ADJUSTMENT—AUTOMATIC CHOKE

A stop screw on the throttle lever inner flange contacts the carburetor lower body and controls the engine hot curb idle speed. Turn the screw inward (clockwise) to increase engine idle speed and outward (counterclockwise) to decrease the engine idle speed.

Position the choke mechanism so that the choke plate is fully open. Seat the throttle plate in the throttle bore. **It may be necessary to back off on the dashpot adjustment screw to seat the throttle plate in the throttle bore.** Set the idle adjusting screw (Fig. 14) to just make contact with the stop on the lower body; then turn the screw inward (clockwise) an additional turn.

The "Final (Hot) Engine Idle and Fuel Mixture Adjustments" provide the specified rpm required.

FINAL (HOT) ENGINE IDLE SPEED ADJUSTMENT

1 Place the transmission selector lever in neutral position and set the parking brake.

2. Operate the engine at fast idle until the temperature has stabilized (approximately 1200 rpm for 30 minutes).

3. Attach a tachometer to the engine.

On a car with a manual-shift transmission, turn the idle speed

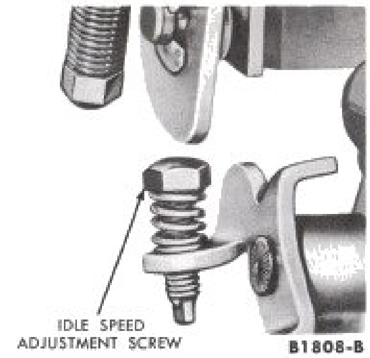

FIG. 13—Idle Speed Adjustment—Manual Choke

"stop" screw in a direction to obtain the specified rpm. Open the throttle by hand and allow it to close normally. Recheck the engine idle speed.

On a car with an automatic transmission, **be sure the parking brake is on.** Place the transmission selector lever in neutral position. Check the engine idle speed and adjust it to the specified rpm in drive range.

Final engine idle speed may be varied to suit the conditions under which the car is to be operated.

4. Remove the tachometer if the idle fuel mixture is not going to be adjusted. If the idle fuel mixture is to be adjusted, leave the tachometer installed so that the idle speed can be checked after the mixture has been adjusted.

IDLE MIXTURE

The idle fuel mixture is controlled by the idle mixture adjusting needle (Fig. 12). Turn the needle inward to lean the mixture, and outward to enrich the mixture.

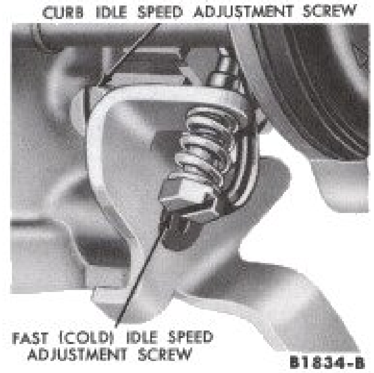

FIG. 14—Idle Speed Adjustment—Automatic Choke

1. Adjust the engine idle speed.

2. Make the initial mixture adjustment, if necessary, by turning the needle screw inward until it lightly seats; then back it off the specified number of turns.

3. Be sure the engine is at normal operating temperature.

4. Turn the mixture screw inward until the engine rpm begins to drop from the lean mixture. Turn the needle screw outward until the engine rpm increases and begins to drop again from the rich mixture; then turn the screw inward for maximum engine rpm and smoothness. **Always favor a rich mixture rather than a lean mixture.**

5. Check the engine idle speed and adjust it, if necessary.

VENT VALVE ADJUSTMENT

Set the throttle linkage to the hot idle position. The groove in the vent valve rod should now be even with the open end of the vent (Fig. 15). Bend the arm on the vent valve rod actuating lever (where it contacts the accelerating pump lever) to align the groove with the edge of the bore.

ACCELERATING PUMP ADJUSTMENTS

1. Insert the roll pin in the lower hole ("HI") position in the lever stop hole.

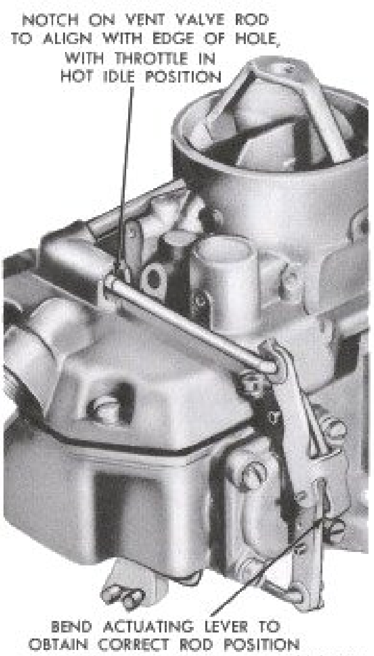

FIG. 15—Float Bowl Vent Valve Adjustment

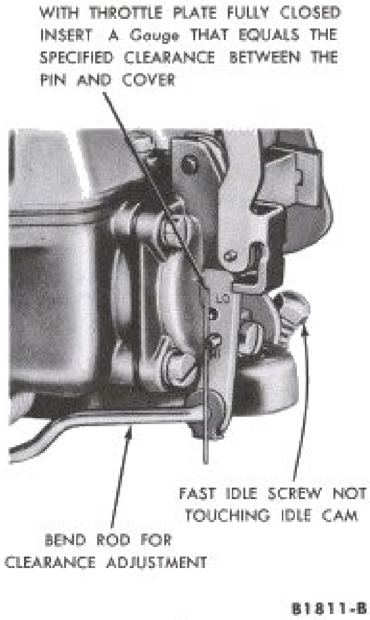

FIG. 16—Accelerating Pump Adjustment

2 Position the throttle and choke linkage so that the throttle plate will seat in the throttle bore. Hold the throttle plates in the closed position. Position a gauge or drill of the specified thickness between the roll pin and the cover surface. Bend the accelerating pump actuating rod to obtain the specified gauge or drill clearance between the pump cover and the roll pin in the pump lever (Fig. 16).

Acceleration requirements in various climates are satisfied by controlling the amount of fuel discharged by the accelerating pump. The pump stroke is controlled by changing the location of the roll pin in the lever

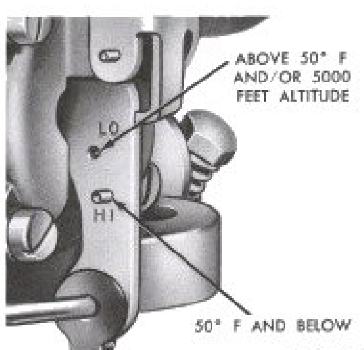

FIG. 17—Accelerating Pump Lever Adjustment

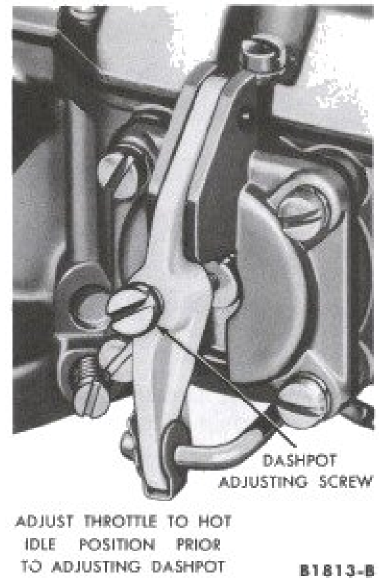

FIG. 18—Anti-Stall Dashpot Adjustment

stop hole (Fig. 17).

For operation in ambient temperatures 50°F. and below, place the roll pin in the hole of the pump operating lever marked "HI" (lower hole). For best performance and

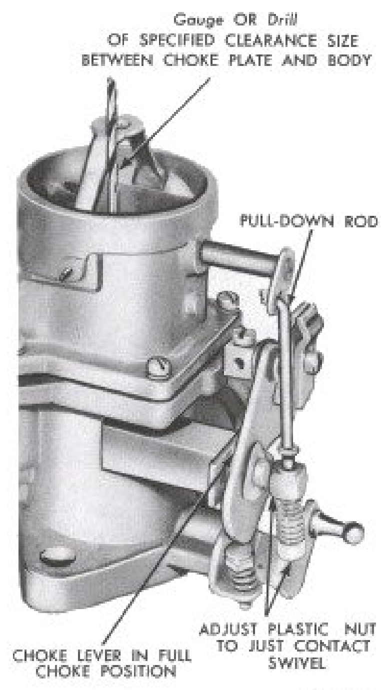

FIG. 19—Manual Choke (Pull-Down) Adjustment

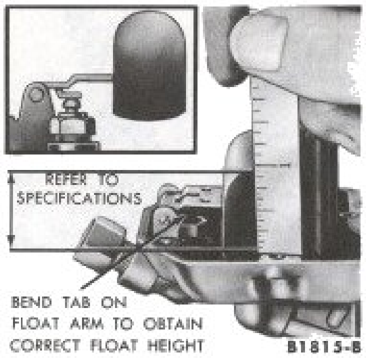

FIG. 20—Carburetor Float Adjustment

economy at normal amibient temperatures and high altitude (above 50°F. and/or above 5,000 feet altitude), place the roll pin in the "LO" (upper hole) of the lever.

ANTI-STALL DASHPOT ADJUSTMENT

1. Adjust the throttle position to the hot idle setting. Turn the dashpot adjusting screw outward until it is clear of the dashpot plunger assembly.

2. Turn the dashpot adjusting screw (Fig. 18) inward until it initially contacts the dashpot plunger assembly; then, turn the adjusting screw inward (clockwise) the specified number of turns against the dashpot diaphragm plunger assembly.

MANUAL CHOKE (PULL DOWN) ADJUSTMENT

Place the choke linkage in the full-choke position. Insert a drill or gauge of the specified size between the choke plate and the inside of the air horn; then while maintaining the full-choke position, adjust the choke pull-down nut to just contact the swivel on the cam lever (Fig. 19).

FLOAT ADJUSTMENT

1. With the carburetor upper-body and mounting gasket removed from the carburetor assembly, turn the upper-body upside down.

2. Measure the distance from the gasket surface of the upper body to the crown (extreme top) of the float (Fig. 20). If the float adjustment is not within the specified dimension, bend the float arm tab, as necessary, to obtain the specified dimension. **Do not apply pressure on the fuel inlet needle. The viton tip of the fuel inlet needle may be damaged through undue pressure exerted on it and thus cause an improper fuel level within the bowl.**

THROTTLE LINKAGE ADJUSTMENT

MANUAL-SHIFT TRANSMISSION

1. Adjust the engine idle speed to specification.

2. Loosen the accelerator shaft to bellcrank rod retaining nut (Fig. 21). Adjust the accelerator shaft to bellcrank rod to obtain the specified pedal height (Fig. 21). Tighten the retaining nut.

3. Adjust the carburetor connecting linkage, as necessary, to allow a smooth, bind-free operation.

AUTOMATIC TRANSMISSION

The throttle linkage adjustments for the automatic transmisions are covered in Group 7.

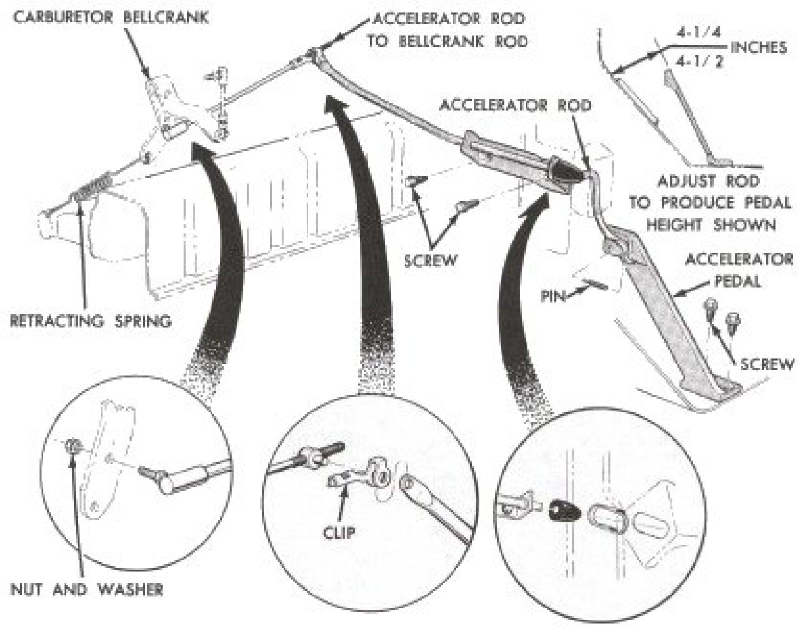

FIG. 21—Throttle Linkage—6-Cylinder Engine

3 REMOVAL AND INSTALLATION

REMOVAL

Flooding, stumble on acceleration, and other performance complaints are, in many instances, caused by the presence of dirt, water, or other foreign matter in the carburetor. To aid in diagnosing the complaint, the carburetor should be carefully removed from the engine without removing the fuel from the bowl. The contents of the bowl may then be examined for contamination as the carburetor is disassembled.

1. Remove the air cleaner from the air horn of the carburetor.

2. Disconnect the throttle shaft lever linkage, choke control cable, fuel line, choke air line (on automatic choke carburetors), and the distributor vacuum line.

3. Remove the carburetor and gasket from the intake manifold. Discard the gasket.

INSTALLATION

1. Clean the gasket surface of the carburetor and the intake manifold. Position a new gasket on the intake manifold.

2. Install the carburetor and tighten the retaining nuts, evenly and alternately, to specification.

3. Connect the choke cable and throttle linkage to the carburetor. Adjust the cable and linkage, if necessary.

4. Connect the fuel inlet line, choke line (on automatic choke carburetors), and the distributor vacuum line. Install the air cleaner.

5. Adjust the idle fuel mixture, engine idle speed, and the anti-stall dashpot (automatic transmission). Refer to "In-Car Adjustments and Repairs" in Part 10-2, Section 2 for the proper procedures.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

Use a separate container for the component parts of the various assemblies, to facilitate cleaning, inspection and assembly.

The following is a step by step sequence of operations for completely overhauling the carburetor. However, certain components of the carburetor may be serviced without a complete disassembly of the entire unit.

Disassembled views of the carburetor are shown in Figs. 23, 24, 25, 26 and 27.

MANUAL CHOKE LINKAGE

1. Depress the tangs on the fast idle cam lever retainer and remove the retainer from the stud (Fig. 22).
2. Remove the fast idle cam lever and the rod assembly from the stud. Move the lever and the rod assembly clockwise and remove it from the choke shaft lever.
3. Remove the rod adjusting nut and the spring from the rod. Slide the rod out of the swivel.
4. Remove the fast idle cam stud and the choke cable bracket assembly from the body. Scribe an index mark on the cable bracket and lower body for installation purposes.

AUTOMATIC CHOKE

1. Remove the choke pulldown rod to throttle lever retainer (Fig. 27).

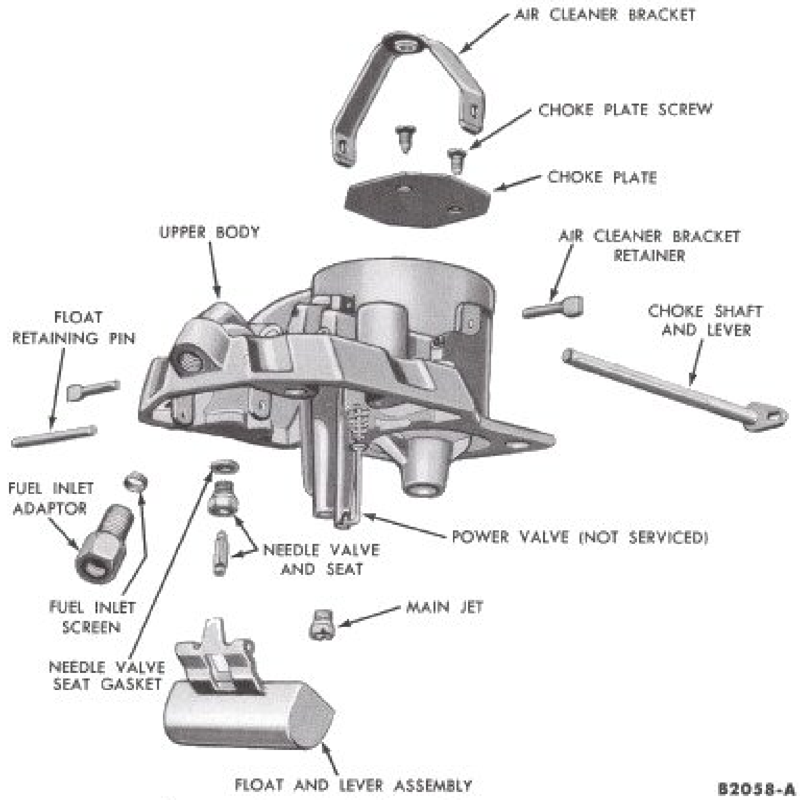

FIG. 24—Carburetor Upper Body Assembly—Manual Choke

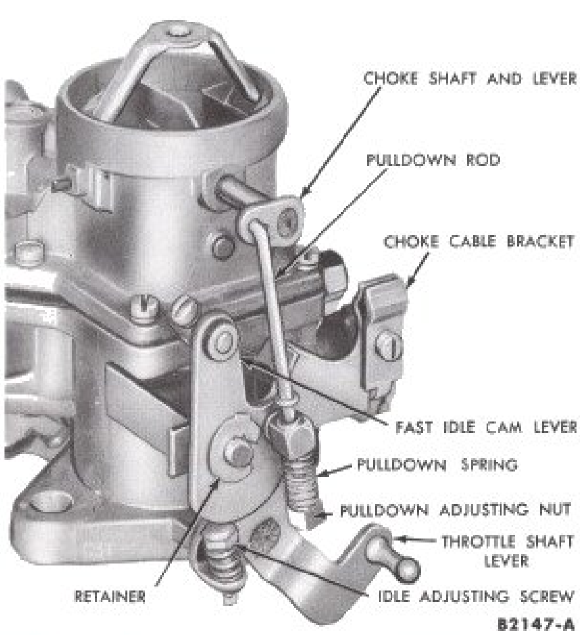

FIG. 22—Manual Choke Linkage—Installed

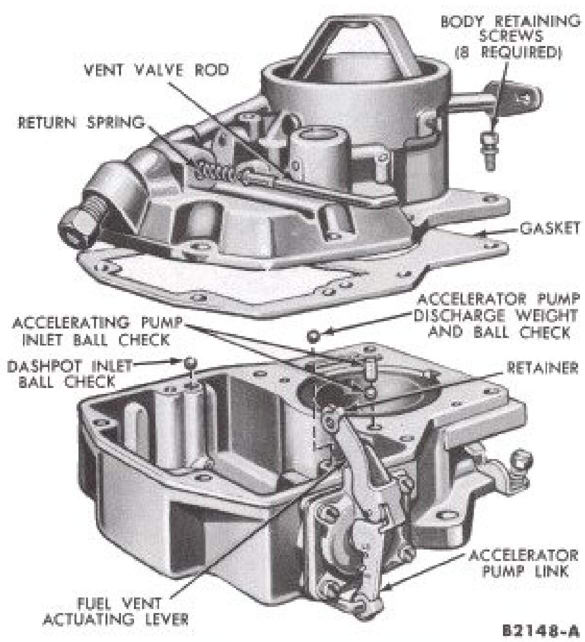

FIG. 23—Carburetor Partial Disassembly

2. Remove the thermostat housing to choke housing screws. Remove the thermostat housing and the gasket.

3. Remove the choke housing to lower body screws. Rotate the choke housing to disconnect the choke control rod and remove the choke housing and the gasket.

4. Remove the choke control lever to thermostatic choke shaft screw. Remove the choke control lever assembly and the spring. Slide the choke shaft out of the choke housing.

5. Remove the choke control rod from the lever.

6. Remove the choke pulldown rod adjusting nut from the rod. Slide the rod out of the swivel.

FUEL VENT VALVE ROD

1. Remove the fuel bowl vent rod to accelerating pump actuating lever retainer (Fig. 23).
2. Remove the stake marks at the vent rod opening with a scraper or file.
3. Remove the vent rod assembly and spring by pulling the vent rod outward.

UPPER AND LOWER BODY

1. Remove the upper to lower body retaining screws and the carburetor identification tag. Separate the upper body assembly, gasket and lower body assembly (Fig. 23). Discard the gasket.
2. Invert the lower body assembly and allow the accelerating pump discharge weight and ball check, the accelerating pump inlet ball check, and the dashpot ball check, if so equipped, to fall into the hand.

UPPER BODY

1. Remove the float retaining pin and the float assembly (Fig. 24).
2. Remove the fuel inlet needle valve. Remove the needle valve seat and gasket. Discard the gasket.
3. Remove the main jet.
4. Remove the fuel inlet fitting and the screen assembly.
5. Remove the air cleaner bracket retaining roll pins with pliers. Turn them in a direction that will coil the pins to a smaller diameter. If they offer resistance to turning, turn them in the opposite direction. Pull the

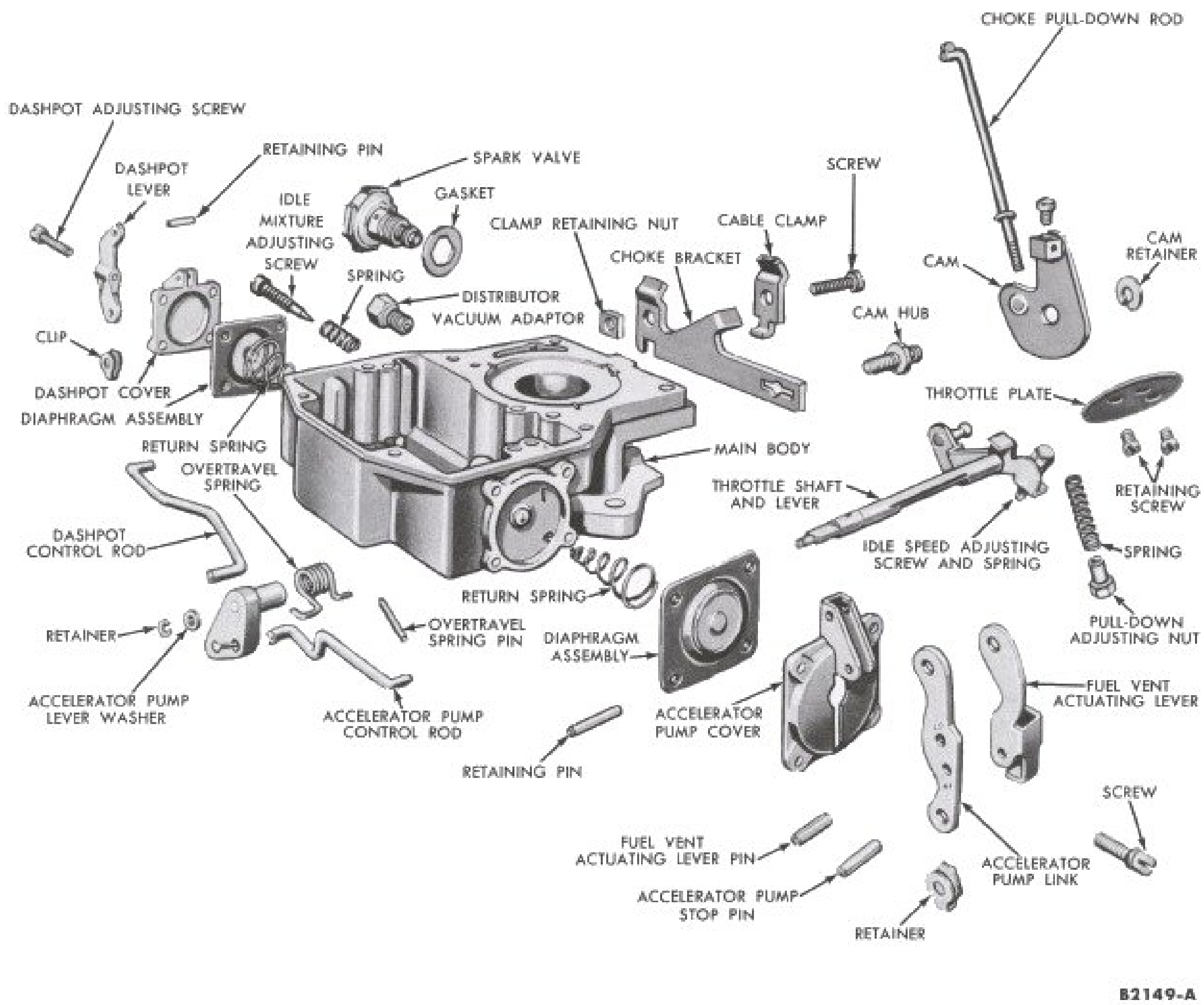

FIG. 25—Carburetor Lower Body Assembly—Manual Choke

bracket out of the retaining channels.

6. If it is necessary to remove the choke plate and shaft, lightly scribe the choke along the choke shaft so that the choke plate can be installed in the same position during installation.

Remove the choke plate screws. The retaining screws are staked in the choke shaft. If the tips of the screws are flared excessively, file off the flared portion to avoid damage to the threads in the choke shaft. Be careful not to damage the choke shaft or venturi while filing the screws. Remove the choke plate from the top of the air horn by sliding the plate out of the shaft. Slide the shaft out of the body.

LOWER BODY

1. Depress the tab on the accelerating pump lever and control rod retaining clip and slide the rod out of the lever (Fig. 25). Remove the clip from the lever.

2. Remove the accelerating pump cover retaining screws. Remove the cover assembly from the lower body. Separate the pump diaphragm and spring from the cover or lower body. If necessary, remove the fuel vent rod actuating lever to cover retaining pin and the accelerating pump lever to cover retaining pin. Remove the lever and rod from the cover.

3. If the carburetor is equipped with a dashpot, depress the tab on the dashpot lever and control rod retaining clip, and slide the rod out of the dashpot lever. Remove the dashpot cover retaining screws and remove the cover assembly. Separate the diaphragm and spring from the cover or body. If necessary, remove the lever to cover retaining pin and remove the lever from the cover.

4. Remove the throttle shaft lever and retaining ring and washer. Remove the lever and overtravel spring from the throttle shaft. Remove the accelerator pump and dashpot control rods from the lever.

5. Remove the distributor vacuum outlet adapter.

6. Remove the spark valve and the gasket.

7. Remove the idle mixture adjusting screw and spring.

8. If it is necessary to remove the throttle plate and shaft, lightly scribe the throttle plate along the throttle shaft so that the throttle plates can be installed in the same position during installation.

Remove the throttle plate retaining screws and slide the plate out of the shaft. For assembly purposes, note that the dimple in the throttle plate is located below the throttle shaft. **The retaining screws are staked in the throttle shaft.** If the tips of the screws are flared excessively, file off the flared portion to avoid damage to the threads in the throttle shaft. Be careful not to damage the throttle shaft or venturi while filing the screws.

9. Remove the overtravel spring tension pin from the throttle shaft and slide the shaft out of the body.

PARTS REPAIR OR REPLACEMENT

Clean and inspect the carburetor component parts. Refer to Part 10-1, Section 3, for the proper procedure. Replace all worn or damaged parts.

ASSEMBLY

Make sure all holes in the new gaskets have been properly punched and that no foreign material has adhered to the gaskets.

During assembly of the carburetor, certain adjustments are required. The details of these adjustments are covered in Part 10-2, Section 2, under "In-Car Adjustments and Repairs".

Disassembled views of the carburetor are shown in Figs. 23, 24, 25, 26 and 27.

UPPER BODY

1. If the choke plate and the shaft were removed, insert the choke shaft assembly into the air horn with the lever pointing toward the accelerating pump side of the carburetor (Fig. 21).

Refer to the line previously scribed on the choke plate and insert the choke plate into its original position with the plate indentation facing upward and toward the accelerating pump side of the carburetor. Install the choke plate retaining screws snug, but not tight.

Check for proper plate fit, binding in the air horn and free rotation of the shaft by moving the plate from the closed position to the open position. If it moves freely, tighten the choke plate retaining screws while holding the plate in the fully-closed position. Stake the screws. **When staking the screws, support the shaft and plate on a block of wood or a metal bar to prevent bending of the shaft.**

2. Install the fuel inlet screen and adapter in the fuel inlet of the body.

3. Install the main jet in the main fuel well.

4. Install the needle valve seat gasket and the seat within the tapped seat hole. Tighten the needle valve seat firmly. Insert the needle valve into the needle valve seat, with the viton tip toward the seat.

5. Position the float assembly in the body, with the tab on the arm located over the needle valve and the hinge of the arm lined up between the hinge bracket holes in the upper body casting. Insert the float hinge pin through the holes in the upper body and float assembly.

6. Check the float setting. Refer to Part 10-2, Section 2 for the proper procedure.

7. Insert the air cleaner bracket in the channels of the air horn and install the bracket retaining pins.

LOWER BODY

1. If the throttle plate and shaft were removed, slide the throttle shaft into the lower body, with the lever on the throttle shaft located opposite the fuel bowl and the fast idle adjusting screw facing upward (Fig. 25).

Refer to the line previously scribed on the throttle plate and insert the plate through the slot in the throttle shaft. The plate indentation must face the bottom of the body and point toward the accelerator pump. Install the throttle plate screws snug, but not tight.

Rotate the throttle shaft while lightly tapping the throttle plate within the throttle bore. Check for free rotation of the throttle shaft. Hold the lower body up to the light. **Little or no light should show between the throttle plate and throttle bore.** When the plate is properly located, hold the throttle plate closed; then, tighten and stake the retaining screws. **When staking the screws, support the shaft and plate on a block of wood or a metal bar to prevent bending of the shaft.**

2. Install the distributor vacuum outlet fitting.

3 If the lever was removed from the accelerating pump cover, position the top hole of the lever between the top bracket holes in the

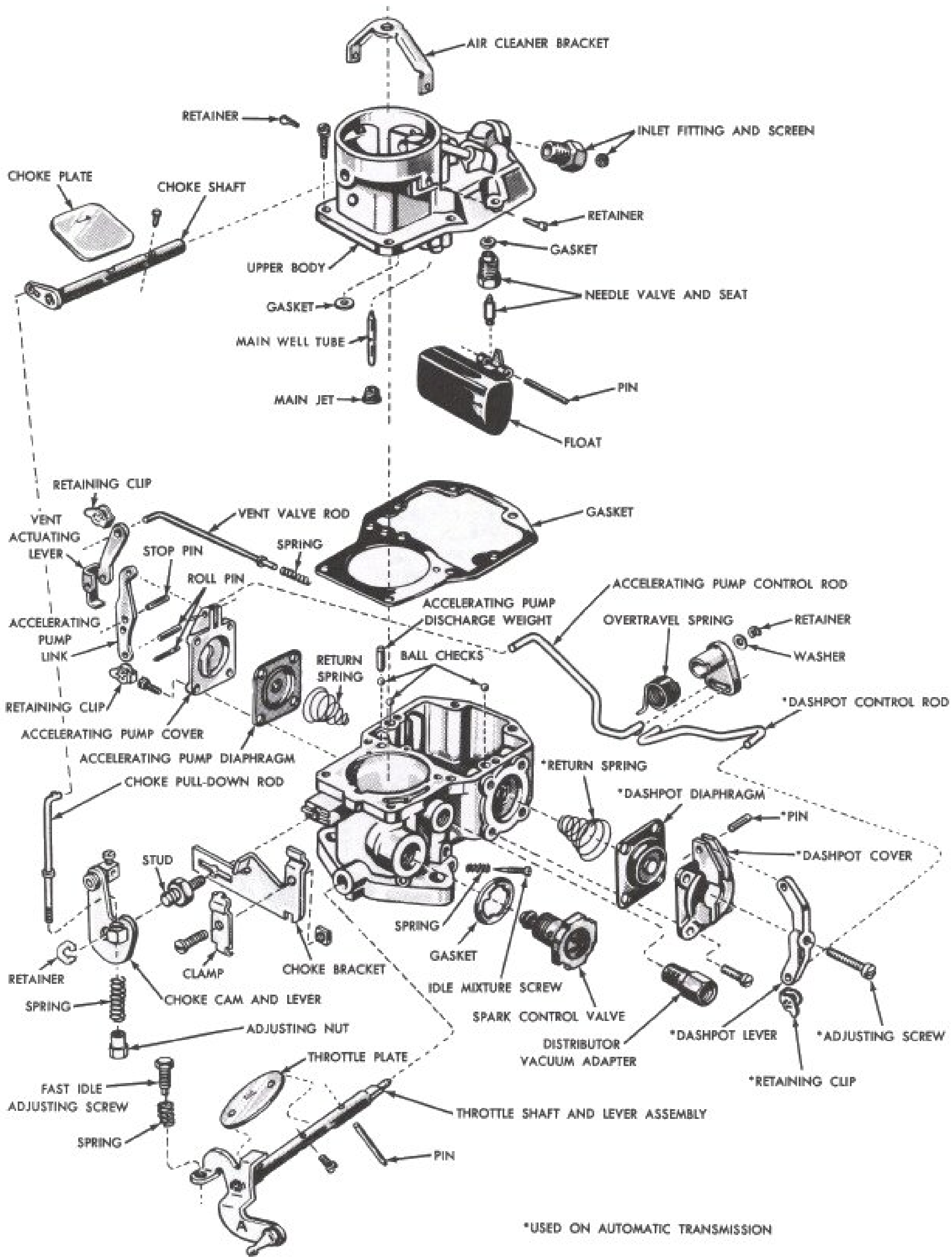

FIG. 26—Ford Single-Barrel Carburetor—Manual Choke—Disassembled

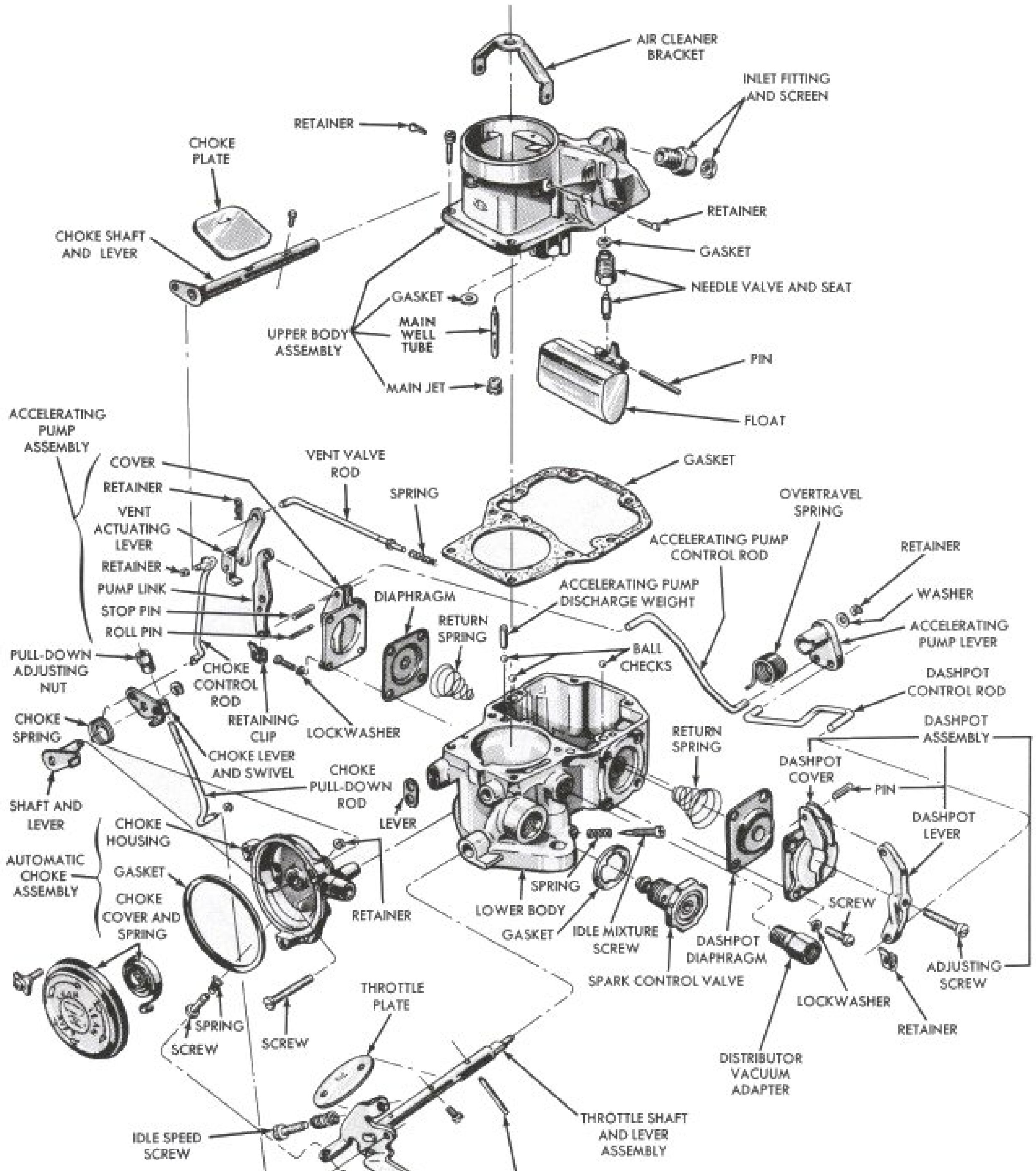

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FIG. 27—Ford Single-Barrel Carburetor—Automatic Choke—Disassembled

cover; then, install the retaining roll pin.

Position the vent rod lever over the pump cover bracket. Line up the hole in the lever with the holes in the bracket and install the retaining roll pin.

Install the roll pin in the "HI" (lower) stop hole in the lever.

Position the small diameter end of the diaphragm return spring in the boss in the accelerating pump chamber. Position the diaphragm assembly in the accelerating pump cover and line up the holes. Position the cover and diaphragm over the return spring and onto the body. Install the cover retaining screws finger-tight. Push the diaphragm assembly inward and tighten the screws.

4. If the carburetor is equipped with a dashpot (Fig. 25), proceed with the following steps:

If the lever was removed from the dashpot cover, position the hole in the lever between the holes in the bracket on the cover. Install the lever retaining roll pin. Install the adjusting screw in the lever, if necessary.

Position the small diameter of the diaphragm return spring in the boss in the dashpot chamber. Position the diaphragm in the dashpot cover and line up the holes. Position the cover and the diaphragm over the return spring and onto the body. Install the cover retaining screws finger tight. Push the diaphragm assembly inward and tighten the screws.

5. Position the overtravel spring (Fig. 25) on the accelerating pump lever and hook the tang of the spring on the lever. Position the accelerating pump lever and spring on the throttle shaft and insert the accelerating pump actuating rod and dashpot actuating rod, if so equipped, into the two holes in the lever.

6. Install the overtravel tension spring retaining pin in the throttle shaft. Pull the arm of the spring over the retaining pin to apply spring tension to the overtravel lever.

7. Position the accelerating pump actuating rod retaining clip over the hole in the accelerating lever, with the tab side of the clip toward the carburetor barrel (Fig. 25). Depress the tab and insert the shorter end of the rod through the lever and clip. Release the tab when the rod is inserted. Perform the "Accelerating Pump Adjustments" after the carburetor is assembled.

8. If the carburetor is equipped with a dashpot, position the dashpot actuating rod retaining clip over the hole in the dashpot lever, with the tab side of the clip facing toward the carburetor barrel (Fig. 25). Depress the tab and insert the shorter end of the rod through the lever and clip, then release the tab when the rod is inserted. Perform an "Anti-Stall Dashpot Adjustment" after the carburetor is assembled.

9. Position the spark valve gasket over the spark valve and install them into the lower body (Fig. 25). Tighten the valve securely. **A loose valve will cause poor engine operation.**

10. Install the idle mixture adjusting screw and spring in the lower body (Fig. 25). Perform the "Initial Idle Mixture Setting" after the carburetor is assembled.

UPPER TO LOWER BODY ASSEMBLY

1. Place the ball check and the accelerating pump weight into the lower body accelerating pump outlet passage (Fig. 23). Insert a ball check in the accelerating pump inlet passage.

2. If the carburetor is equipped with a dashpot, insert a ball check in the dashpot inlet passage (Fig. 23).

3. Install the upper to lower body gasket onto the lower body. **Make certain the word "TOP"** (inscribed on the gasket) is facing upward. Position the upper body on the lower body and gasket. Install the body retaining screws.

FUEL VENT VALVE ROD

1. Insert the fuel vent valve return spring in the fuel vent passage in the upper body (Fig. 23). Insert the piston end of the fuel vent rod in the passage.

2. Position the fuel vent valve rod retaining clip over the hole in the actuating lever, with the tab side of the clip toward the carburetor air horn. Depress the tang on the clip and connect the rod to the actuating lever.

3. Punch three indentations in the vent valve passage opening with a center punch and a hammer. The indentations must distort the inside edge of the opening sufficiently to act as a stop for the piston end of the vent rod. Perform a "Vent Valve Adjustment" after the carburetor is assembled.

AUTOMATIC CHOKE

1. When facing the cam side of the choke housing, position the choke shaft spring over the bushing hub with the hook of the spring on the cam finger (spring windup will rotate the cam counterclockwise).

2. Hold the cam finger clockwise and against the stop of the housing, then rotate the spring counterclockwise until the spring straight end passes the cam finger. Position the choke control lever over the fast idle cam, with the pulldown swivel away from the housing and the short tang between the cam finger and the spring straight end.

3. Insert the thermostatic choke shaft assembly into the choke housing from the bimetal spring side of the housing and into the choke control lever (The pull down swivel and the thermostatic spring arm should be aligned and not opposite), and install the retaining screw.

4. Insert the threaded end of the choke pulldown rod through the swivel (from the bottom) and install the adjusting nut.

5. Position the short end of the choke control rod into the keyhole in the choke housing choke lever.

6. Insert the choke assembly retaining screws into the choke housing. Position the choke control gasket and the choke housing onto the lower body, connecting the rod to the choke plate shaft. Start the retaining screws into the body.

7. Insert the end of the choke pull down rod into the throttle shaft lever hole and install the retainer.

8. Check the position of the choke control gasket and tighten the retaining screws.

9. Position the thermostatic spring cover gasket and cover to the choke

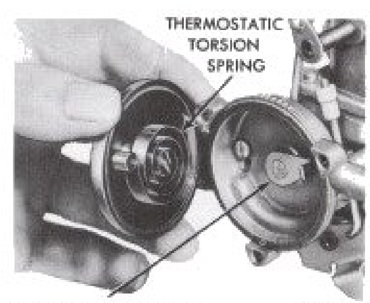


FIG. 28—Correct Position of Automatic Choke Torsion Spring

housing, making sure the loop at the end of the thermostatic spring is on the choke lever (Fig. 28). The spring must wind clockwise toward the center when viewed from the choke housing side of the carburetor. Align the index mark on the cover with the center index mark on the choke housing. The final setting is made as an "In-Chassis Adjustment".

11. Install the cover onto the choke housing with the retaining screws.

NOTE: The "Automatic Choke Linkage (Pulldown) Adjustment" and the "Automatic Choke Fast Idle Adjustment" must be made as a "Carburetor Bench Adjustment".

MANUAL CHOKE

1. Position the choke cable bracket assembly onto the lower body assembly (Fig. 25). Align the previously scribed marks on the bracket and lower body and install the stud.

2. Insert the threaded end of the choke shaft to cam lever rod through the cam lever swivel. Install the spring and adjusting nut onto the rod (Fig. 25).

3. Position the rod end into the keyhole in the choke shaft lever; then insert the rod and turn it counterclockwise (Fig. 22).

4. Position the cam lever assembly over the stud and install the retainer (Fig. 22). Perform a "Manual Choke (Pull-down) Adjustment" prior to installation of the carburetor.

BENCH ADJUSTMENTS

All carburetor adjustments with the exception of the "Final (Hot) Engine Idle and Fuel Mixture Adjustments," can be performed prior to installing the carburetor in the car.

Refer to "In-Car Adjustment and Repair" in Part 10-2, Section 2 for the proper carburetor adjustment procedures.

PART 10-3 FORD DUAL CARBURETORS

1 DESCRIPTION AND OPERATION

DESCRIPTION

The Ford dual-carburetors are used on the 260 and 289 V-8 engines.

The carburetors (Figs. 1 and 2) have two main assemblies, the air horn and the main body.

The air horn assembly, which serves as the main body cover, contains the choke plate and the vents for the fuel bowl.

The throttle plate, the accelerating pump assembly, the power valve assembly, and the fuel bowl are in the main body. The automatic choke housing is attached to the main body.

The two barrels each contain a main and booster venturi, main fuel discharge, accelerating pump discharge, idle fuel discharge and a throttle plate.

Due to similarity of the carburetors, the description and operating principles apply to all carburetors. Differences in various carburetor items are noted where applicable.

OPERATION

FUEL INLET SYSTEM

The amount of fuel entering the fuel bowl (Fig. 3) is regulated by the distance the fuel inlet needle is raised off its seat and by fuel pump pressure. Movement of the fuel inlet needle in relation to the seat is controlled by the float and lever assembly which rises and falls with the fuel level. When the fuel in the fuel bowl reaches a pre-set level, the float lowers the fuel inlet needle to a position where it restricts the flow of fuel, admitting only enough fuel to replace that being used.

An integral retracting clip is attached to the fuel inlet needle assembly. The clip hooks over the tab of the float assembly. This clip assures reaction of the fuel inlet needle to any downward movement of the float.

A wire-type retainer prevents movement of the float shaft within the guides on each side of the fuel bowl. The retainer fits into a groove on the outside of the fuel inlet needle seat The ends of the retainer are hooked over grooves on opposite ends of the float shaft.

A torsion (fuel pulsation damper) spring is located on the float shaft, between the inboard end of the float retainer, and the float shaft guide in

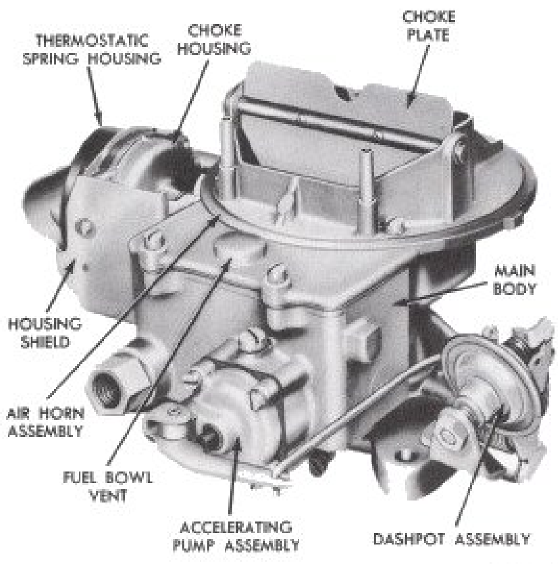


FIG. 1—Ford Dual Carburetor—3/4 Left Front View

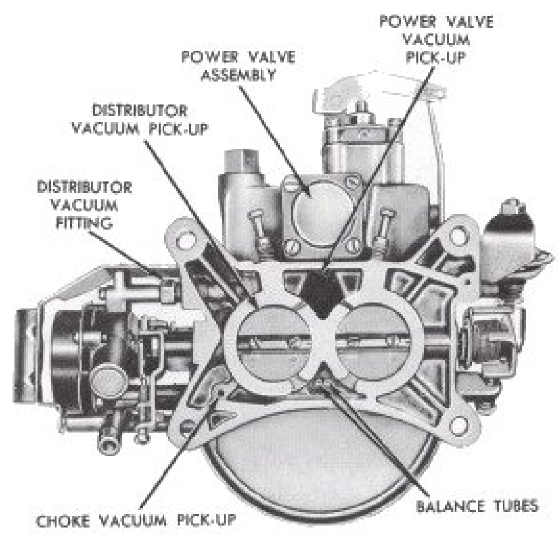


FIG. 2—Ford Dual Carburetor Vacuum Piston Choke—Bottom View

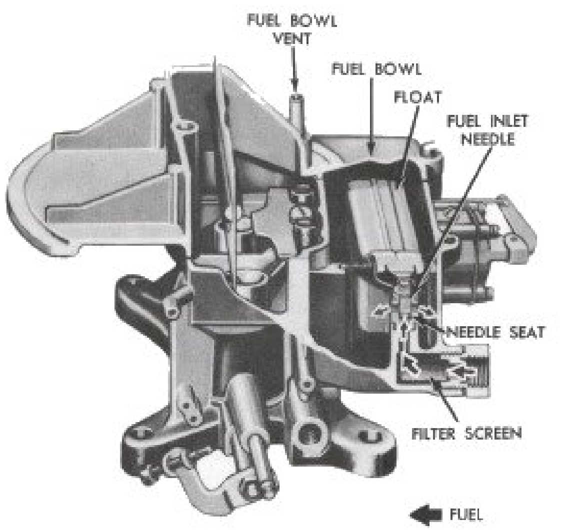


FIG. 3—Fuel Inlet System

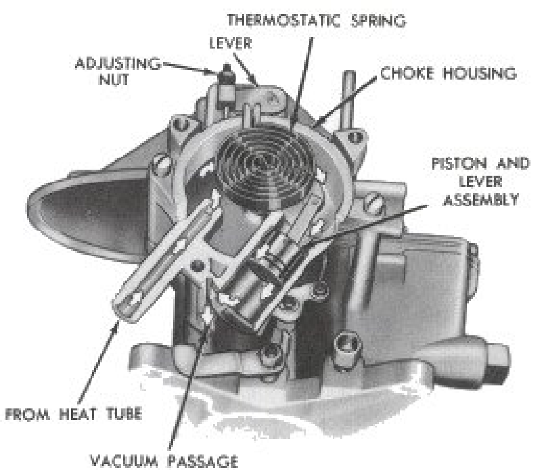


FIG. 4—Automatic Choke System—Vacuum Piston Choke

the fuel bowl. The short end of the spring rests under the float lever, and the long end of the spring rests against the inner face of the fuel bowl.

The torsion spring tension resists and absorbs fuel pump pressure pulsations, and movement of fuel in the bowl due to driving conditions. This assures proper regulation of the fuel inlet needle which rises and falls with the fuel level.

The fuel bowl is internally vented into the air cleaner. It is also externally vented to the atmosphere.

AUTOMATIC CHOKE SYSTEM

The choke plate, located in the air horn above the barrels, when closed, provides a high vacuum above as well as below the throttle plates. With a vacuum above the throttle plates, fuel will flow from the main fuel system as well as from the idle fuel system. This provides the extremely rich fuel mixture necessary for cold engine operation.

The carburetor choke shaft is linked to a thermostatic choke control mechanism mounted on the main body (Fig. 4).

The linkage between the choke lever and the throttle shaft is designed so that the choke plate will partially open when the accelerator is fully depressed. This permits unloading of a flooded engine.

The automatic choke is equipped with a bi-metal thermostatic spring and a vacuum piston (Fig. 4). The bi-metal thermostatic spring mechanism winds up when cold and unwinds when warm. When the engine is cold, the thermostatic spring, through attaching linkage, holds the choke piston upward and the choke plate in a closed position prior to engine start. Manifold vacuum channeled through a passage in the choke control housing, draws the choke vacuum piston downward, exerting an opening force on the choke plate.

When the engine is started, manifold vacuum, acting directly on the piston located in the choke housing, immediately moves the plate against the tension of the thermostatic spring to a partially open position to prevent stalling.

As the engine continues to operate, manifold vacuum draws heated air from the exhaust manifold heat chamber. The amount of air entering the choke housing is controlled by restrictions in the air passages in the carburetor.

The warmed air enters the choke housing and heats the thermostatic spring causing it to unwind. The tension of the thermostatic spring gradually decreases as the temperature of the air from the heat chamber rises, allowing the choke plate to open. The air is exhausted into the intake manifold.

When the engine reaches its normal operating temperature, the thermostatic spring exerts tension on the choke plate forcing it to the full open position. In this position, the choke piston is at its lowest point in the cylinder. Slots in the piston chamber wall allow sufficient air to bleed past the piston and into the intake manifold, causing a continual flow of warm air to pass through the thermostatic spring housing. The spring thus remains heated and the choke plate remains fully open until the engine is stopped and allowed to cool.

The choke rod actuates the fast idle cam during choking. Steps on the edge of the fast idle cam contact the fast idle adjusting screw which permits a faster engine idle speed for smoother running when the engine is cold. As the choke plate is moved through its range of travel from the closed to the open position, the choke rod rotates the fast idle cam. Each step on the fast idle cam permits a slower idle rpm as engine temperature rises and choking is reduced.

During the warm-up period, if the engine should reach the stall point due to a lean mixture, manifold vacuum will drop considerably. The tension of the thermostatic spring then overcomes the lowered vacuum

acting on the choke piston, and the choke plate will be moved toward the closed position, providing a richer mixture to help prevent stalling.

The linkage between the choke lever and the throttle shaft is designed so that the choke plate will patrially open when the accelerator pedal is fully depressed. This permits unloading of a flooded engine.

IDLE FUEL SYSTEM

The difference in pressure between the fuel bowl and the idle discharge port forces fuel through the idle fuel system. Fuel flows from the fuel bowl through the main jet and into the bottom of the main well (Fig. 5).

From the main well, the fuel flows up through the idle tube and through a short diagonal passage in the booster venturi assembly into the idle passage in the main body. A calibrated restriction, at the upper tip of the idle tube, meters the flow of fuel.

Air enters the idle system from the air bleed which is located directly above the idle tube. The air bleed also acts as a vent to prevent siphoning at off idle or high speeds and when the engine is stopped. Additional air is bled into the system through an air bleed located at the bottom of the diagonal passage in the booster venturi where the fuel enters the idle passage in the main body.

Fuel flows down the idle passage in the main body past three idle transfer holes. The idle transfer holes act as additional air bleeds at curb idle The fuel then flows past the pointed tip of the adjusting needle which controls the idle fuel discharge. From the adjusting needle chamber, the fuel flows through a short horizontal passage and is discharged below the throttle plates.

During off idle when the throttle plate is moved slightly past the idle transfer holes, each hole begins discharging fuel as it is exposed to manifold vacuum. As the throttle plate is opened still wider and engine speed increases, the air flow through the carburetor is also increased. This creates a vacuum in the booster venturi strong enough to bring the main fuel system into operation. Fuel flow from the idle fuel system begins tapering off as the main fuel system begins discharging fuel.

ACCELERATING SYSTEM

Upon accelerating, the air flow through the carburetor responds almost immediately to the increased throttle opening. There is, however, a brief interval before the fuel, which is heavier than air, can gain speed and maintain the desired balance of fuel and air. During this interval, the accelerating system (Fig. 6) supplies fuel until the other systems can once again provide the proper mixture.

When the throttle is closed, the diaphragm return spring forces the diaphragm toward the cover, drawing fuel into the chamber through the inlet. The inlet has a ball check which opens to admit fuel from the fuel bowl and closes when the accelerating pump is operated to prevent a reverse flow. A discharge weight and ball check prevents air from entering when fuel is drawn into the chamber.

When the throttle is opened, the diaphragm rod is forced inward, forcing fuel from the chamber into the discharge passage. Fuel under pressure forces the pump discharge weight and ball off their seat and fuel passes through the accelerating pump discharge screw and is sprayed into each main venturi through discharge ports.

An air bleed in the wall of the accelerating pump fuel chamber prevents vapor entrapment and pressure build-up in the diaphragm chamber.

An accelerating pump cavity filler, located in the accelerating pump fuel chamber, decreases the volume of the accelerating pump cavity. The filler improves the rate of fuel delivery, and prevents engine stumble and hesitation on acceleration.

MAIN FUEL SYSTEM

As engine speed increases, the air passing through the booster venturi creates a vacuum. The amount of vacuum is determined by the air flow

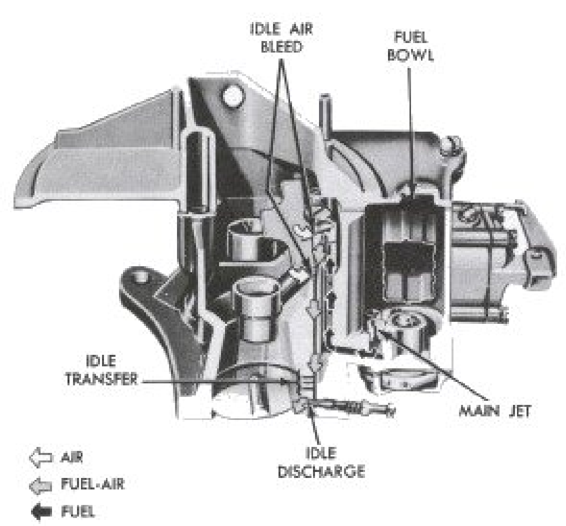


FIG. 5—Idle Fuel System

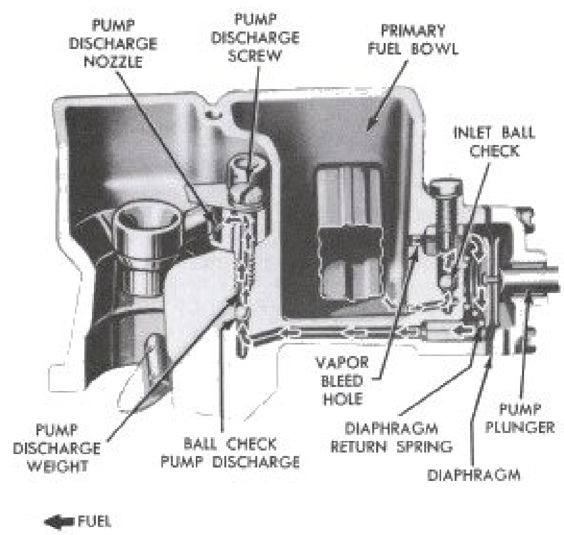


FIG. 6—Accelerating Pump System

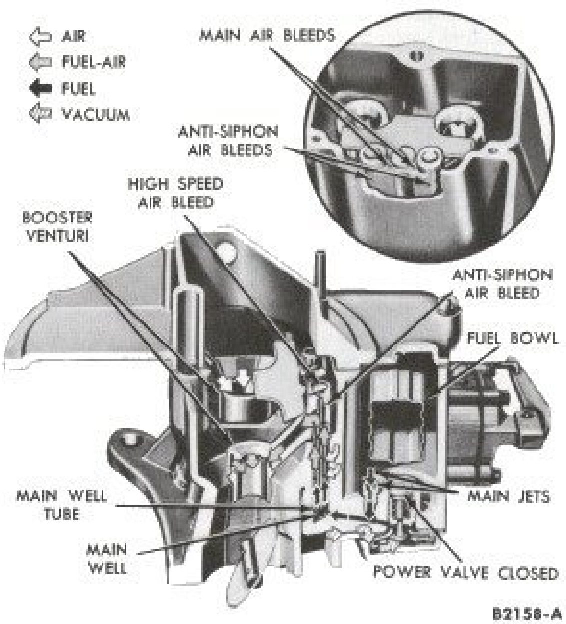


FIG. 7–Main Fuel System

through the venturi, which in turn is regulated by the speed of the engine. The difference in pressure between the main discharge port and the fuel bowl causes fuel to flow through the main fuel system (Fig. 7).

At a predetermined venturi vacuum, fuel flows from the fuel bowl, through the main jets, and into the bottom of the main well. The fuel moves up the main well tube past air bleed holes. Filtered air from the high speed air bleed enters the fuel flow in the main well tube through holes in the side of the tube. The high speed air bleed meters an increasing amount of air to the fuel as venturi vacuum increases, maintaining the required fuel-air ratio. The mixture of fuel and air is lighter than raw fuel and responds faster to changes in venturi vacuum. It also vaporizes more readily than raw fuel. The fuel and air continue up the main well tube past another air bleed which also acts as a vent to prevent siphoning when the engine is shut down. The fuel is discharged into the booster venturi where it is vaporized and mixed with the air flowing through the carburetor.

The throttle plate controls the amount of the fuel-air mixture admitted to the intake manifold, regulating the speed and power output of the engine.

A balance tube is located in each barrel directly below the booster venturi. When decelerating, the balance tube siphons off any excess fuel droplets remaining around the edge of the booster venturi and discharges the droplets into the equalizing slots in the base of the carburetor where they are mixed with the idle fuel. The balance tube also acts as an additional air bleed during the idle fuel system operation.

POWER FUEL SYSTEM

During periods of increased road loads or high speed operation, the fuel-air ratio must be increased for added power. The added fuel required during this period is supplied by the power fuel system (Fig. 8).

The power fuel system is controlled by the manifold vacuum.

Manifold vacuum is transmitted from an opening in the base of the main body, through a passage in the main body and power valve chamber to the power valve diaphragm. The manifold vacuum, acting on the power valve at idle speed or normal road load conditions, is great enough to hold the power valve diaphragm down, overcoming the tension of the spring on the valve stem and holding the valve closed. When high power operation places a greater load on the engine and manifold vacuum

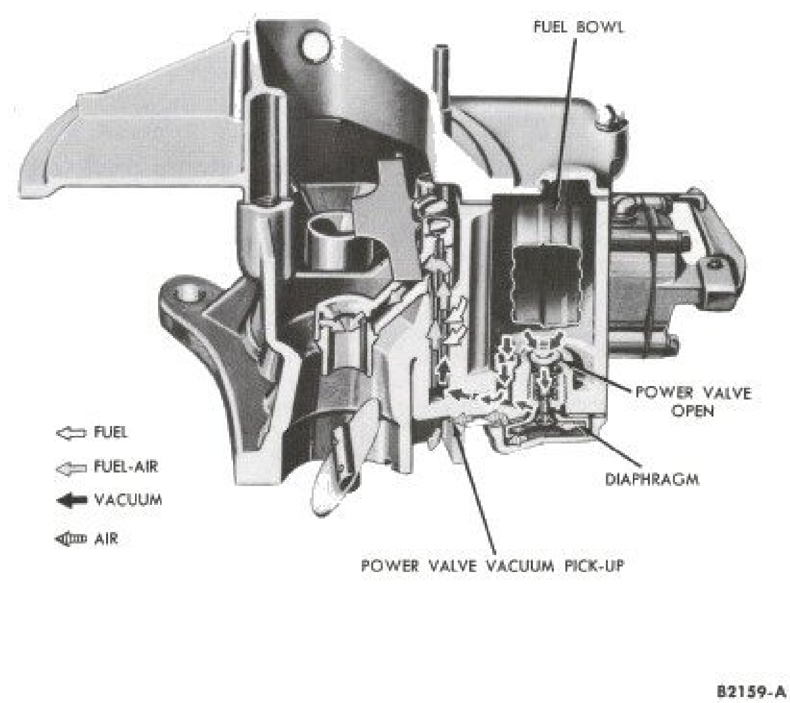


FIG. 8–Power Fuel System

drops below a predetermined value, the spring opens the power valve. Fuel from the fuel bowl flows through the power valve and into passages leading to the main fuel well. Here the fuel is added to the fuel from the main fuel system, enriching the mixture.

As engine power demands are reduced, manifold vacuum increases. The increased vacuum overcomes the tension of the valve stem spring and closes the power valve.

2 IN-CAR ADJUSTMENTS AND REPAIRS

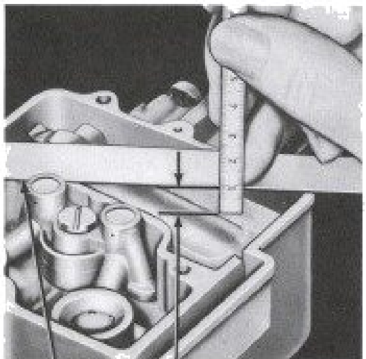


FIG. 9—Ford Dual Carburetor Fuel Measurement—Typical

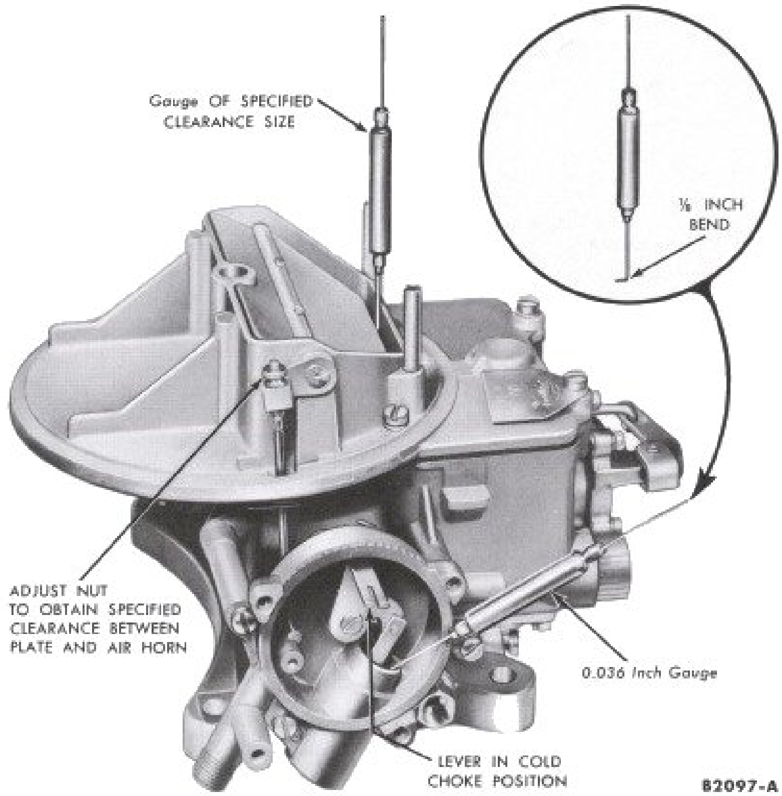


FIG. 10—Vacuum Piston Choke Plate Clearance (Pull-Down) Adjustment

The fuel level float adjustment (dry) is performed only as a bench adjustment. Refer to Part 10-1 for the proper float adjustment (dry) procedure. The choke clearance (pull-down) and fast idle cam linkage adjustments are usually performed with the carburetor on the bench; however, they can be performed with the carburetor on the engine.

FUEL LEVEL FLOAT ADJUSTMENT (WET)

The dry (bench) float level setting is a preliminary adjustment performed during carburetor overhaul procedures on the bench. This setting is used as a guide only; therefore, a final check and adjustment of the wet fuel level should be made as follows:

1. Operate the engine for 30 minutes at 1200 rpm to normalize engine temperatures, and place the car on a flat surface as near level as possible. Stop the engine.

2. Remove the air cleaner assembly, carburetor air horn assembly, and gasket.

3. Temporarily place the air horn gasket in position on the carburetor main body. Let the engine idle for several minutes, then remove the air horn gasket.

4. While the engine is idling, use a standard depth scale to measure the vertical distance from the top machined surface of the carburetor main body to the level of the fuel in the fuel bowl (Fig. 9). The measurement must be made at least ¼ inch away from any vertical surface to assure an accurate reading, because the surface of the fuel is concave (higher at the edges than at the center). Care must be exercised to measure the fuel level at the point of contact with the fuel. Refer to the specifications for the correct fuel level (wet) setting.

5. **If any adjustment is required, stop the engine to minimize the hazard of fire** due to fuel spray when the float setting is disturbed. To adjust the fuel level, bend the float (contacting the fuel inlet valve) upward in relation to the original position to raise the fuel level and downward to lower it. Each time an adjustment is made to the float tab to alter the fuel level, the engine must be started and permitted to idle at least three minutes to stabilize the fuel level. Check the fuel level after each adjustment until the specified level is achieved.

6. Install the new horn air gasket and carburetor air horn assembly.

7. Check the idle fuel mixture

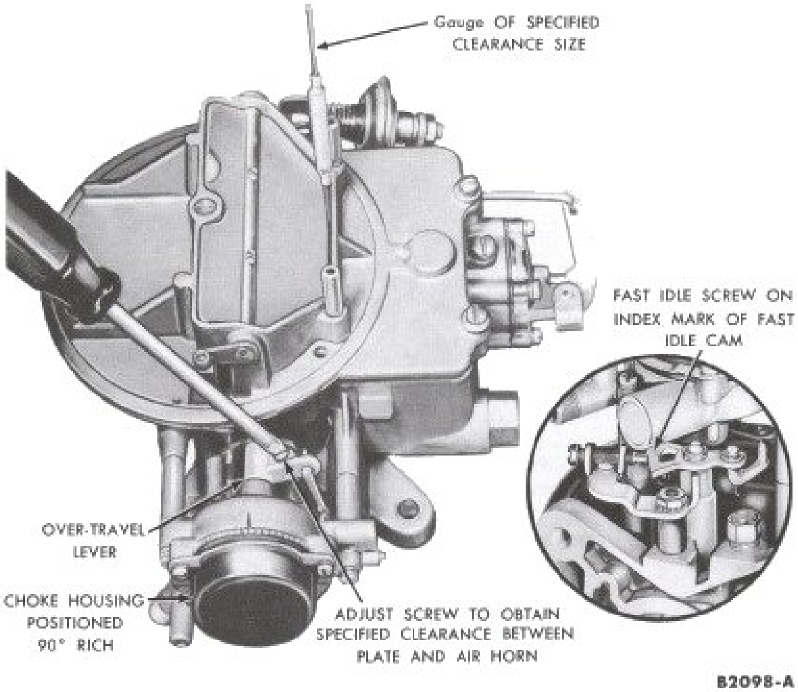


FIG. 11—Fast Idle Cam Linkage Adjustment

and idle speed adjustments. Adjust the carburetor as required.

8. Install the air cleaner assembly.

AUTOMATIC CHOKE-PLATE CLEARANCE (PULL-DOWN) AND FAST IDLE CAM LINKAGE ADJUSTMENT

1. Bend a 0.036 inch wire gauge (tool) at a 90° angle, approximately ⅛ inch from its end (Fig. 10).

2. Remove the choke thermostatic spring housing if it has not been removed. Block the throttle about half-open so that the fast idle cam does not contact the fast idle adjustment screw.

3. Insert the bent end of the gauge between the lower edge of the piston slot and the upper edge of the right hand slot in the choke housing (Fig. 10), and pull the choke countershaft lever counterclockwise until the gauge is snug in the piston slot. Hold the wire gauge in place by exerting light pressure on the countershaft lever, and adjust the choke plate clevis (pull-down)adjusting nut to obtain the specified clearance between the front of the choke plate and the air horn (Fig. 10).

4. Install the choke thermostatic spring housing and gasket. Install the housing retainer and the retaining screws.

5. Position the fast idle (rpm) adjustment screw on the index mark of the fast idle cam (Fig. 11).

6. Turn the choke thermostatic cover 90° rich (counterclockwise) and check the clearance between the front of the choke plate and the air horn (Fig. 11). Adjust the clearance to specification, if required. **Turn the over-travel lever adjusting screw clockwise (inward) to increase the clearance and counterclockwise (outward) to decrease the clearance. Make certain the fast idle screw remains on the index mark (kickdown step) of the fast idle cam during the adjustment procedure.**

7. Set the choke thermostatic housing to the specified index mark. Tighten the housing clamp retaining screws. Adjust the engine idle speed and idle fuel mixture.

AUTOMATIC CHOKE THERMOSTATIC SPRING HOUSING ADJUSTMENT

1. If the heater hose and mounting bracket and the carburetor air cleaner assembly have not been previously removed, remove them from the carburetor.

2. Loosen the thermostatic spring housing clamp retaining screws. Set the spring housing to the specified index mark (Fig. 12) and tighten the clamp retaining screws.

3. Install the heater hose and bracket on the carburetor and tighten the bracket retaining screws. If other carburetor adjustments are not required, install the carburetor air cleaner assembly.

IDLE FUEL MIXTURE AND IDLE SPEED ADJUSTMENTS

The engine idle speed is adjusted to settings for a hot engine, and a cold (fast idle speed) during choke operation. With the air cleaner removed, make the idle adjustments in the following sequence:

INITIAL IDLE MIXTURE SETTING

If necessary, initially set the idle mixture by turning the idle mixture screws (needles) inward (clockwise) until lightly seated; then, turn the screws outward (counterclockwise) 1-1½ turns (Fig. 13). **Do not turn the needles tightly against their seats as this may groove the ends.** If the needle(s) is damaged it must be replaced before a satisfactory fuel mixture can be obtained.

ENGINE IDLE SPEED AND MIXTURE

1. Operate the engine for 30 minutes at 1200 rpm to stabilize engine temperatures.

On a car with an air conditioner, operate the air conditioner for 20 minutes before setting the engine idle speed.

2. Set the parking brake. Attach a tachometer to the engine.

3. **On a car with a manual shift transmission, the engine idle speed**

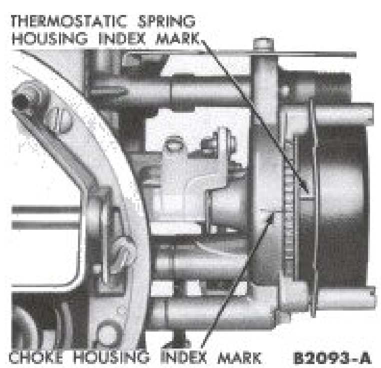


FIG. 12—Automatic Choke Thermostatic Spring Housing Adjustment—Typical

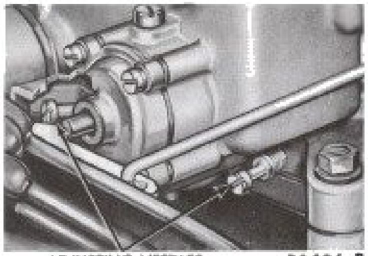


FIG. 13—Idle Fuel Mixture Adjustment

is checked and adjusted with the gear shift lever in the neutral position. On a car with an automatic transmission, the engine idle speed is checked and adjusted with the transmission selector lever in the drive range position.

Place the transmission selector lever in neutral position on a car with a manual-shift transmission, or in drive range on a car with an automatic transmission. Check the engine idle speed. Adjust the engine idle speed to specification by turning the engine idle speed adjustment screw (Fig. 14) inward (clockwise) to increase the speed or outward (counterclockwise) to decrease the speed. **When performing this adjustment, be sure the dashpot is not interfering with the throttle lever or the fast idle adjusting screw is not contacting the fast idle cam.**

4. Turn each idle mixture screw (needle) inward (Fig. 13) until the engine rpm begins to drop from the lean mixture and turn each needle outward until engine rpm increases and begins to drop from the rich mixture. Turn the needles inward for maximum engine rpm and smoothness. The needles should be turned approximately the same amount. The final setting may vary approximately ½ turn difference between needles.

5. After the correct engine idle fuel mixture has been obtained, it is necessary to check the idle speed. **If the car is equipped with an automatic transmission, place the transmission selector lever in neutral position.** Manually open and close the throttle. **If the car is equipped with an automatic transmission, place the transmission selector lever in drive range.** Check the engine idle speed and adjust, if necessary.

Final engine idle speed may be varied to suit the conditions under which the carburetor is to be operated.

ENGINE FAST (COLD) IDLE SPEED

The adjusting screw on the right side of the carburetor (Fig. 15) contacts one edge of the fast idle cam. The cam permits a faster engine idle speed for smoother running when the engine is cold during choke operation. As the choke plate is moved through its range of travel from the closed to the open position, the fast idle cam pick-up lever rotates the fast idle cam. Each position on the fast idle cam permits a slower idle rpm as engine temperature rises and choking is reduced.

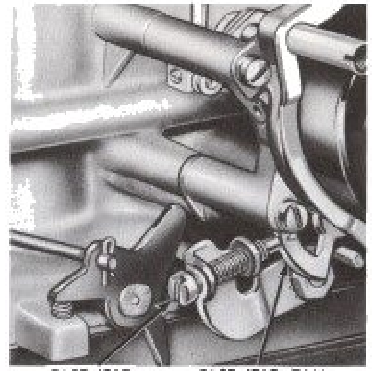


FIG. 15—Engine Fast (Cold Engine) Idle

1. Manually rotate the fast idle cam until the fast idle adjusting screw rests adjacent to the shoulder of the highest step (align screw with the arrow mark on the cam (Fig. 15).

2. Start the engine, and turn the fast idle adjusting screw inward or outward as required to obtain the specified fast idle rpm.

3. Remove the tachometer if the idle fuel mixture does not require adjustment. If the idle fuel mixture requires adjustment, leave the tachometer installed so that the idle speed can be checked after the idle fuel mixture has been adjusted.

ANTI-STALL DASHPOT ADJUSTMENT

The anti-stall dashpot adjustment is made with the carburetor air

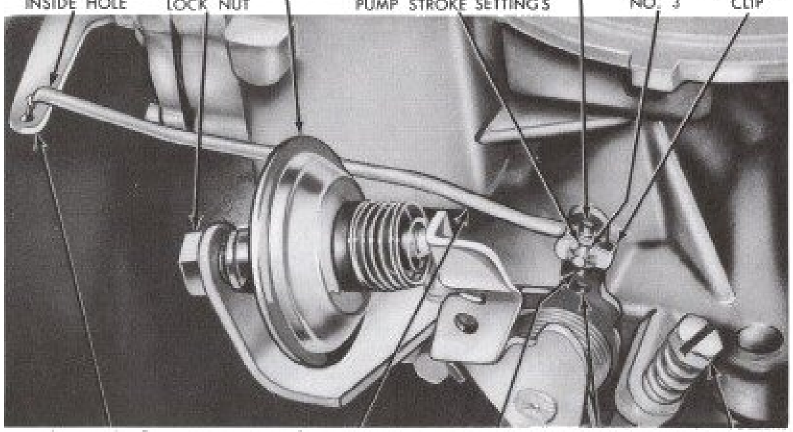


FIG. 14—Typical Idle Adjustments—Left Side

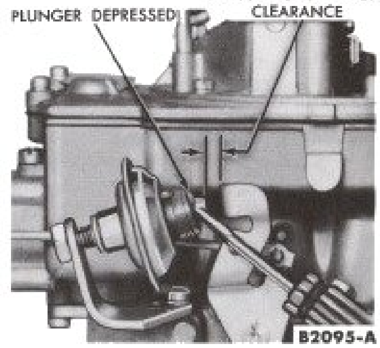


FIG. 16—Anti-Stall Dashpot Adjustment—Typical

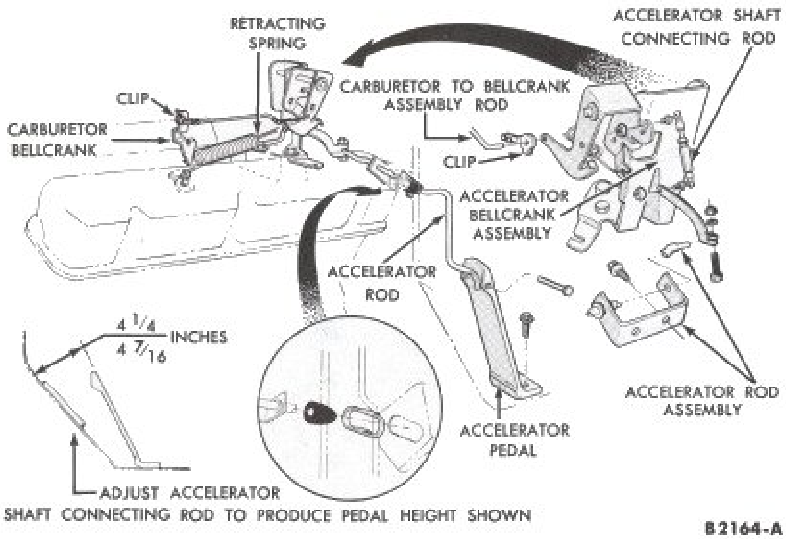


FIG. 17—Throttle Linkage Adjustment—8-Cylinder

cleaner assembly removed from the carburetor.

1. With the engine idle speed and mixture properly adjusted, and the engine at normal operating temperature, loosen the anti-stall dashpot lock nut (Fig. 16).

2. Hold the throttle in the closed position and depress the plunger with a screwdriver blade. Check the clearance between the throttle lever and the plunger tip with a feeler gauge of the specified clearance dimension. Turn the anti-stall dashpot in its bracket in a direction to provide the specified clearance between the tip of the plunger and the throttle lever. Tighten the locknut to secure the adjustment.

3. Install the air cleaner assembly.

ACCELERATING PUMP STROKE ADJUSTMENT

The accelerating pump stroke adjustment is made with the carburetor air cleaner removed from the carburetor.

The over-travel lever has four holes and the accelerating pump link has two holes (Fig. 14) to control the accelerating pump stroke for various ambient temperatures and operating conditions of the engine.

The correct position for the pump link operating rod for all climatic conditions is in the inboard hole of the link (hole closest to the pump plunger). Refer to specifications, and insert the operating rod in the proper hole of the over-travel lever to suit the climatic conditions in which the car is to be operated.

To release the operating rod from the over-travel lever, retaining clip, press the ends of the clip together; then, at the same time, press the rod away from the clip until it is disengaged. Remove the clip. To install the operating rod in the over-travel lever, install the clip on the over-travel lever. Press the ends of the clip together; then at the same time, insert the rod through the clip and over-travel lever. Release the ends of the clip.

THROTTLE LINKAGE ADJUSTMENTS

MANUAL-SHIFT ADJUSTMENTS

1. Adjust the engine idle speed to specification.

2. Check the accelerator pedal height (Fig. 17). To adjust the pedal height, disconnect the carburetor connecting rod. Lengthen or shorten the accelerator connecting link to obtain the specified accelerator pedal height.

3. With the throttle lever against the idle adjusting screw, adjust the carburetor connecting rod until the end of the rod has a free fit into the carburetor throttle lever hole.

OVERDRIVE TRANSMISSION

1. Adjust the engine idle speed, pedal height and throttle linkage (Fig. 17) as outlined in steps 1 thru 3 under "Manual-Shift Transmission."

2. With the accelerator shaft held in the full throttle position, slide the overdrive control switch up or down on the elongated slots until the tang on the accelerator shaft assembly (bellcrank) is just touching the switch plunger. If the switch does not touch the shaft when it is in its closest position, an adjustment (not exceeding four turns counterclockwise) may be made at the switch plunger.

3. Return the accelerator shaft to its normal position. Turn the switch plunger five turns counterclockwise to adjust for kickdown operation.

AUTOMATIC TRANSMISSION

The throttle linkage adjustment for the automatic transmissions are covered in Group 7.

3 REMOVAL AND INSTALLATION

REMOVAL

1. Remove the air cleaner. Remove the choke shield retaining screws and remove the heater hose and shield from the carburetor assembly.

2. Remove the throttle rod from the throttle lever. Disconnect the distributor vacuum line, the fuel inlet line and the choke heat tube at the carburetor.

3. Remove the carburetor retaining nuts and lockwashers, then remove the carburetor. Remove the spacer and two gaskets from the manifold.

INSTALLATION

1. Clean the gasket surface of the intake manifold spacer, and carburetor. Place the spacer between two new gaskets and position them on the manifold. Position the carburetor on the spacer and secure it with lockwashers and nuts.

2. Connect the throttle rod, the choke heat tube, and the distributor vacuum line. Position the heater hose on the choke shield and install the shield and retaining screws.

3. Refer to Part 10-3, Section 2,

"In-Car Adjustments and Repairs" and adjust the engine idle speed, the idle fuel mixture, and the anti-stall dashpot (if so equipped). If the car is equipped with a power steering pump idle valve assembly, adjust it as required. Refer to Group 3 for the proper procedure. Install the air cleaner.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

To facilitate working on the carburetor, and to prevent damage to the throttle plates, install carburetor legs on the base. If legs are unavailable, install four bolts about 2¼ inches long of the correct diameter and nuts on the carburetor base.

Use a separate container for the component parts of the various assemblies to facilitate cleaning, inspection and assembly.

The following is a step-by-step sequence of operations for completely overhauling the carburetor for the 260—289 V-8 engine. However, certain components of either of the carburetors may be serviced without a complete disassembly of an entire unit. For a complete carburetor overhaul, follow all of the steps. To partially overhaul either carburetor or to install a new gasket kit, follow only the applicable steps.

Refer to Fig. 30 for parts identification.

AIR HORN

1. Remove the air cleaner anchor screw.
2. Remove the automatic choke control rod retainer.
3. Remove the air horn retaining screws, lock washers and the carburetor identification tag. Remove the air horn and air horn gasket (Fig. 18).

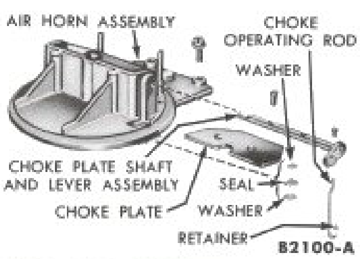


FIG. 18—Air Horn Assembly—Typical

4. Remove the choke control rod by loosening and turning the choke shaft lever clevis nut counterclockwise. Remove the rod from the air horn. Slide the felt seal and two washers out of the air horn.

If it is necessary to remove the choke plate, remove the staking marks on the choke plate retaining screws and remove the screws. Remove the choke plate by sliding it out of the shaft from the top of the air horn. Slide the choke shaft out of the air horn.

If the tips of the screws are flared excessively, file off the flared portion to prevent damage to the threads in the shaft.

VACUUM PISTON CHOKE

1. Remove the fast idle cam retainer Fig 19).

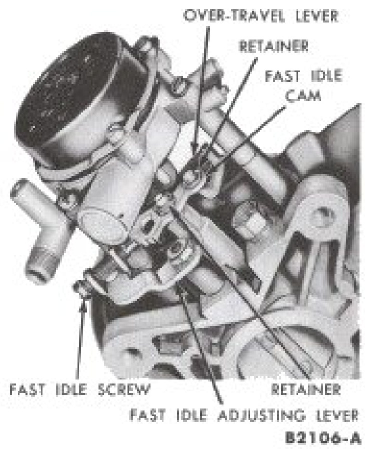


FIG. 19—Fast Idle Cam and Fast Idle Lever

2. Remove the thermostatic choke spring housing retaining screws and remove the clamp, housing and gasket.
3. Remove the choke housing assembly retaining screws. If the air horn was not previously removed, remove the choke control rod retainer. Remove the choke housing assembly, gasket and the fast idle cam. Remove the fast idle cam and rod from the choke over-travel lever.
4. Remove the automatic choke shaft retaining screw and washer (Fig. 20). Remove the choke thermostat lever from the housing. If necessary, remove the pin securing the choke piston to the choke thermostat lever link. Remove the choke shaft and lever assembly, and the over-travel lever from the choke housing.

FIG. 20—Choke Shaft and Lever

MAIN BODY

1. Use a hook to disconnect the float shaft retainer from the float shaft (Figs. 21 and 22). Remove the float, torsion (damper) spring and shaft and the fuel inlet needle and clip assembly from the needle seat.
2. Remove the fuel inlet needle seat and the main jets with a jet wrench (Figs. 23 and 24).
3. Remove the accelerator pump

FIG. 21—Float Assembly

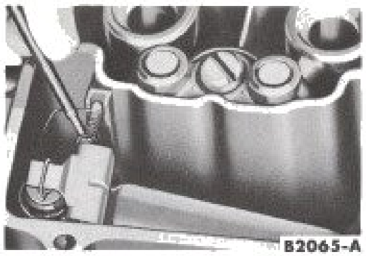


FIG. 22—Float Shaft Retainer Removal or Installation

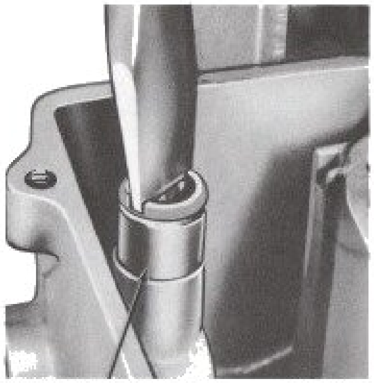


FIG. 23—Fuel Inlet Needle Seat Removal or Installation

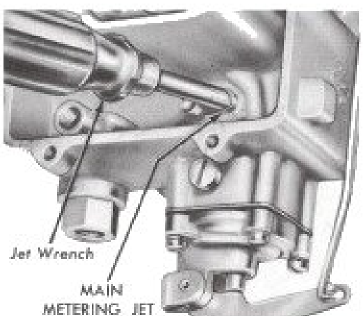


FIG. 24—Main Jet Removal or Installation

discharge screw, air distribution plate (if so equipped), booster venturi and gasket (Fig. 5). Invert the main body and let the accelerating pump discharge weight and ball fall into the hand. Remove the fuel inlet fitting.

4. Remove the accelerator pump operating rod from the over-travel lever and the retainer. **To release the operating rod from the over-travel lever retainer, press the ends of the retainer together; then,**

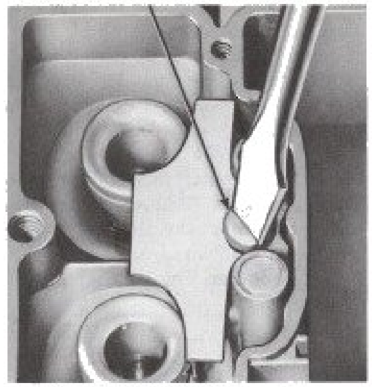


FIG. 25—Booster Venturi Removal or Installation

at the same time, press the rod away from the retainer until it is disengaged. Remove the rod and retainer.

5. Remove the accelerating pump cover, diaphragm assembly, and the spring (Fig 26). Remove the inlet ball check retainer screw and the gasket. Remove the cavity filler. Invert the main body and let the inlet ball check fall into the hand.

6. Invert the main body and remove the power valve cover and the gasket. Remove the power valve with a box wrench (Fig. 27). Remove the power valve gasket. Dis-

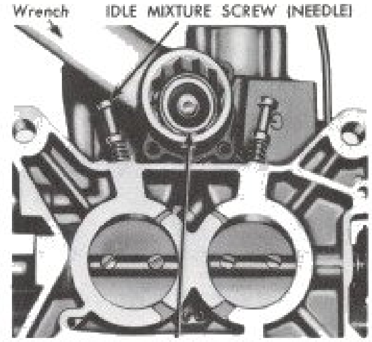


FIG. 27—Power Valve Removal or Installation

card the gasket.

7. Remove the idle fuel mixture adjusting screws (needles) and the springs.

8. Remove the nut and washer securing the fast idle adjusting lever assembly to the throttle shaft, and remove the lever assembly (Fig. 19). If necessary, remove the idle screw and the retainer from the fast idle adjusting lever.

9. If necessary, remove the distributor vacuum line fitting. Remove the anti-stall dashpot, if so equipped.

10. If it is necessary to remove the throttle plates, lightly scribe the throttle plates along the throttle shaft, and mark each plate and its corresponding bore with a number

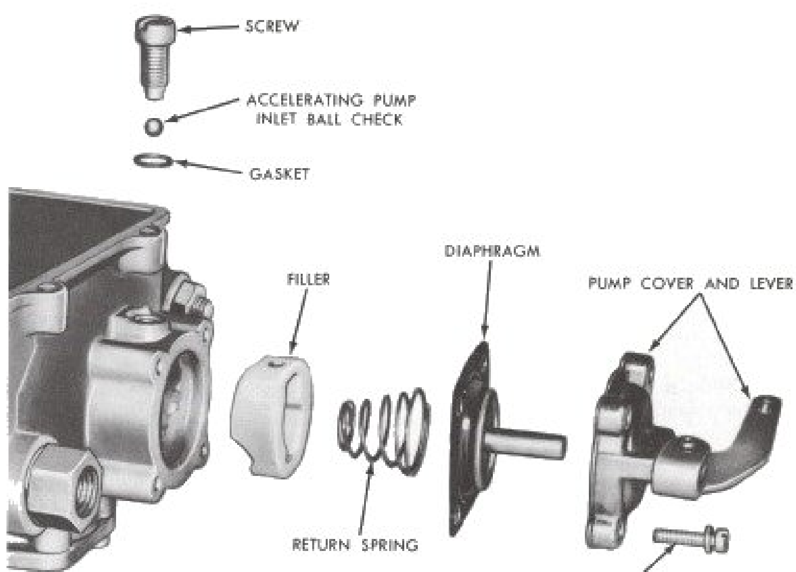


FIG. 26—Accelerating Pump Assembly

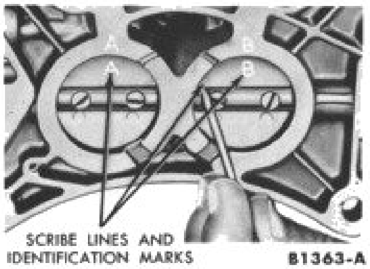


FIG. 28—Throttle Plate Removal

or letter for proper installation (Fig. 28).

11. Slide the throttle shaft out of the main body. Remove the accelerating pump over-travel lever retainer. Slide the anti-friction bearing (bushing), spring and the lever off the throttle shaft (Fig. 29).

PARTS REPAIR REPLACEMENT

Clean and inspect the carburetor component parts. Refer to Part 10-1 for the proper procedure. Replace all worn or damaged parts.

ASSEMBLY

Make sure all holes in the new gaskets have been properly punched and that no foreign material has adhered to the gaskets. Make sure the accelerating pump diaphragm is not torn or cut.

The carburetor assembly is shown in Fig. 30).

MAIN BODY

1. If the throttle plates were removed, install the over-travel anti-friction bushing over the boss on the over-travel lever. Place the over-travel spring, with the shortest tang end first, over the bushing and boss on the over-travel lever. Place the short tang of the spring under the lug on the accelerator over-travel lever.

2. Slide the over-travel lever and spring assembly on the throttle shaft and bushing. Hook the longest tang of the spring under the closed throttle lug of the throttle lever (Fig. 31). Install the over-travel lever retainer. Slide the throttle shaft assembly into the main body.

3. Referring to the lines scribed on the throttle plates, install the throttle plates in their proper location with the screws snug, but not tight. Close the throttle plates. Invert the main body, and hold it up to the light. Little or no light should show between the throttle plates and the throttle bores. Tap the plates lightly with a screwdriver handle to seat them. Hold the throttle plates closed and tighten and stake the retaining screws. **When staking the screws, support the shaft and plate on a block of wood or a metal bar to prevent bending of the shaft.**

4. If necessary, install the engine idle screw retainer and the screw on the fast idle adjusting lever. Install the distributor vacuum passage fitting.

5. Install the anti-stall dashpot, if so equipped.

6. Place the fast idle lever assembly on the throttle shaft and install the retaining washer and nut (Fig. 19).

On a mechanical linkage choke carburetor, install the fast idle cam and the fast idle cam retainer.

7. Drop the accelerating pump inlet ball check into the inlet passage of the accelerating pump chamber (Fig. 26). Seat the ball with a brass drift and a light hammer. Make sure the ball is free in the bore. Install the cavity filler in the pump chamber. Install the retaining screw and washer.

8. Install the accelerating pump diaphragm return spring on the boss

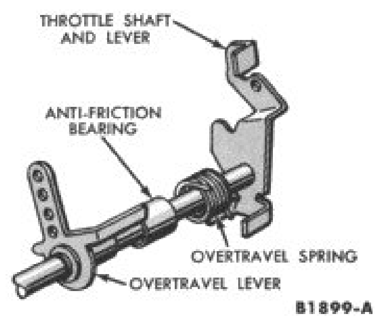


FIG. 29—Throttle Shaft Assembly

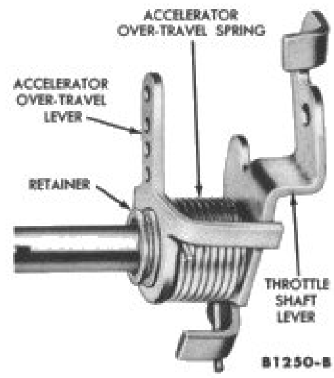


FIG. 31—Accelerator Over-Travel Spring and Lever Installation

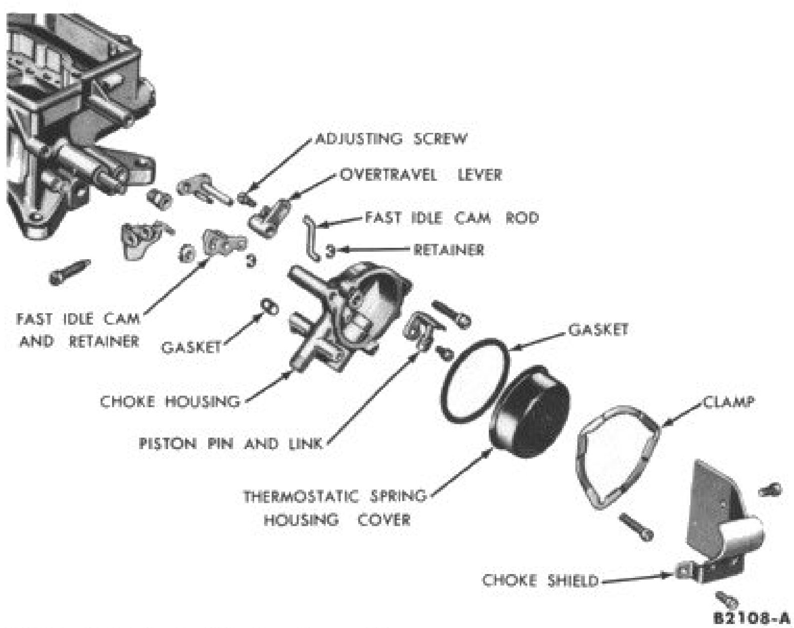


FIG. 32—Choke Housing Assembly

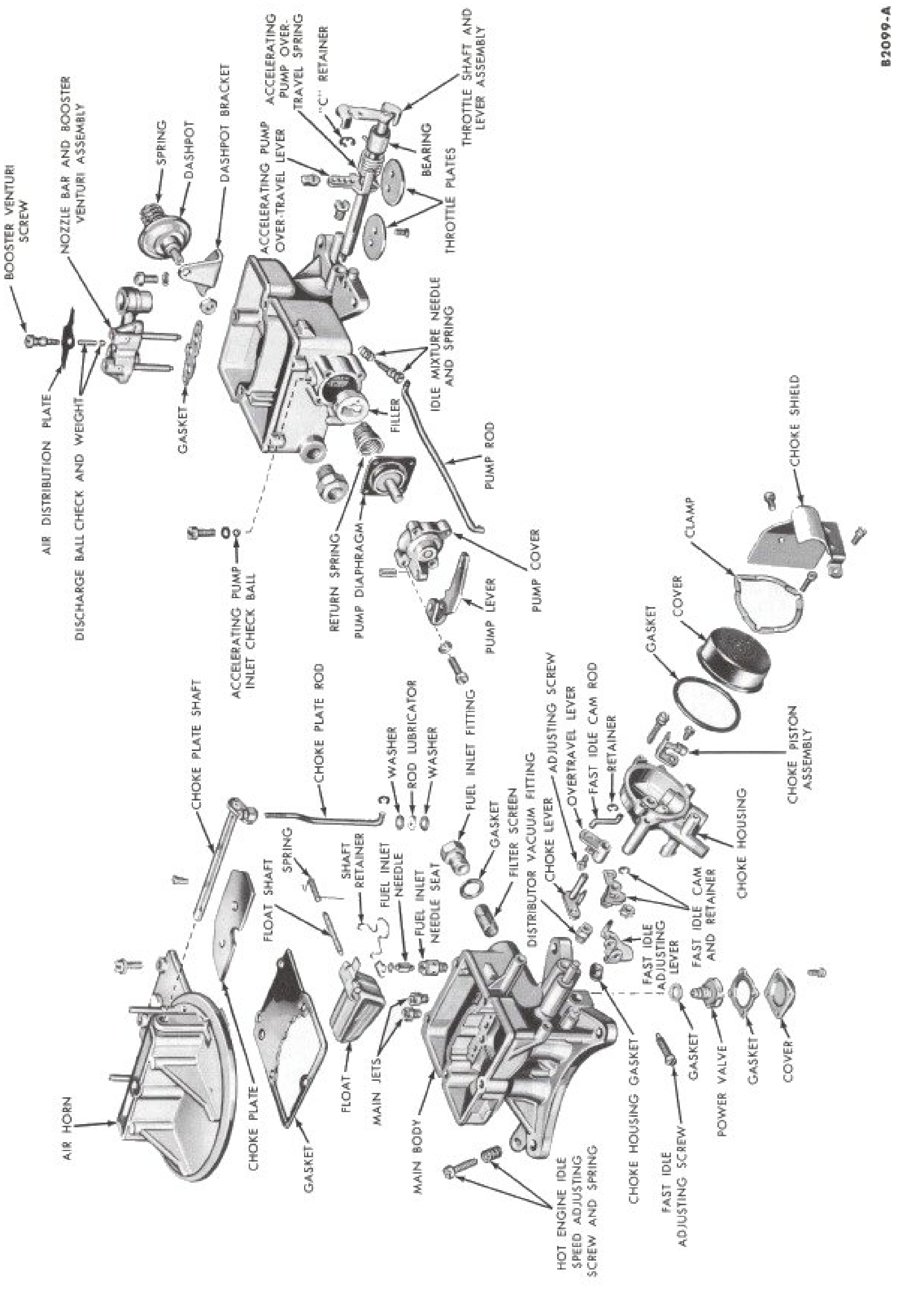


FIG. 30—Ford Dual Carburetor—Disassembled

on the chamber (Fig. 26). Insert the diaphragm assembly in the cover and place the cover and diaphragm assembly in position on the main body. Install the cover screws.

9. Insert the accelerating pump operating rod into the inboard hole of the accelerating pump actuating lever. Position the accelerating pump operating rod retainer over the specified hole (Refer to "Specifications," Part 10-8) in the over-travel lever to suit the operating, and the climatic conditions under which the car is to be operated. Press the ends of the retainer together; then, at the same time, insert the operating rod through the retainer and the hole in the over-travel lever. Release the ends of the retainer to secure the rod.

10. Invert the main body. Install the power valve (economizer valve) and new gasket with a wrench (Fig. 27). **Tighten the valve securely.** Install the power valve cover and gasket.

11. Install the idle mixture adjusting screws (needles) and springs (Fig. 13). Turn the needles in gently with the fingers until they just touch the seat, then back them off 1-1½ turns for a preliminary idle fuel mixture adjustment.

12. Install the main jets and the fuel inlet seat and new gasket, using a jet wrench (Figs. 23 and 24). **Be sure the correct jets are installed.**

13. Position the float shaft retainer in the groove on the fuel inlet needle seat. Install the fuel inlet needle assembly in the fuel inlet seat. The fuel inlet needle and seat are matched assemblies. **Be sure the correct needle and seat are assembled together.**

14. Slide the float shaft into the float lever (Fig. 21). Install the torsion (damper) spring on the float shaft and insert the short end of the spring under the flange of the float lever.

15. Insert the float assembly into the fuel bowl and hook the float tab under the fuel inlet needle assembly. Insert the float shaft into its guides at the sides of the fuel bowl. Allow the long end of the damper spring to rest against the wall of the fuel bowl.

16. Use a hook to position the shaft retainer in the grooves on the shaft (Fig 22). Refer to Part 10-1, and check the float setting.

17. Drop the accelerating pump discharge ball into its passage in the main body. Seat the ball with a brass drift and a light hammer. **Make sure the ball is free in the bore.** Drop the accelerating pump discharge weight on top of the ball. Position the new booster venturi gasket and the booster venturi in the main body. Position the air distribution plate, if so equipped, and install the accelerator pump discharge screw (Fig. 25).

18. Install the fuel inlet filter screen, and the fuel inlet fitting and gasket.

VACUUM PISTON STROKE

1. If the choke piston and link was disassembled install the choke piston on the choke thermostatic spring lever link and install the retaining pin (Fig. 32).

2. Position the over-travel lever on the thermostatic choke shaft and lever assembly (Fig. 32). **The bottom of the over-travel lever adjusting screw must rest against the tang on the choke shaft lever.** Insert the choke shaft assembly into the rear of the choke housing. Position the choke shaft lever so that the hole in the lever is to the left side of the choke housing.

3. Insert the choke piston into the choke housing, and install the choke thermostatic spring lever on the flange of the choke shaft. Install the choke thermostatic spring lever to shaft retaining screw and washer (Fig. 20).

4. Install the fast idle cam rod on the over-travel lever. Place the fast idle cam on the fast idle cam rod and install the retainer. Place the choke housing vacuum pick-up port to main body gasket on the choke housing flange. Position the choke housing on the main body and at the same time, install the fast idle cam on the hub on the main body. Position the gasket, and install the choke housing retaining screws. Install the fast idle cam retainer. **The thermostatic spring housing is installed after the choke plate has been adjusted to specification.**

AIR HORN

Refer to Fig. 18 for the correct location of the parts.

1. If the choke plate shaft was removed, position the choke plate shaft in the air horn. Place the two brass washers and slide them into position on the choke control rod seal retainer.

Insert the choke control rod through the control rod seal and the air horn. Insert the choke control rod into the choke shaft lever clevis nut, and turn the nut clockwise to thread the rod onto the nut.

2. If the choke plate was removed, insert the choke plate into the choke plate shaft. Install the choke plate screws snug, but not tight. Check for proper plate fit, binding in the air horn and free rotation of the shaft by moving the plate from the closed position to the open position. If necessary, remove the choke plate and grind or file the plate edge where it is binding or scraping on the air horn wall. If the choke plate and shaft moves freely, tighten the choke plate screws while holding the choke in the fully-closed position. Stake the screws. **When staking the screws, support the shaft and plate on a block of wood or a metal bar to prevent bending of the shaft.**

3. Position the air horn gasket on the main body, with the fuel bowl vent hole in the gasket located opposite the fuel inlet valve.

4. Position the air horn over the main body and insert the end of the choke lever rod into the automatic choke shaft lever. Install the air horn retaining screws and the carburetor identification tag. Tighten the retaining screws. Install the choke lever rod retainer. Install the air cleaner anchor screw.

5. Refer to Part 10-3, Section 2, "In-Car Adjustments and Repairs" and perform the automatic choke plate clearance (pull-down) and fast idle cam linkage adjustment. Perform a fuel level float adjustment (wet) after the carburetor has been installed on the car.

PART 10-4 FORD 4-BARREL CARBURETOR

1 DESCRIPTION AND OPERATION

DESCRIPTION

The Ford 4-barrel carburetor (Figs. 1, 2 and 3) has two main assemblies; the air horn, and the main body.

The air horn assembly, which serves as the main body cover, contains the choke plate, the vents for the fuel bowls, and the secondary throttle control vacuum tube and the choke plate magnet.

The primary and secondary throttle plates, the accelerator pump assembly, the power valve assembly, the secondary operating diaphragm assembly, and the fuel bowls are in the main body. The automatic choke housing is attached to the main body.

The two primary (front) barrels each contain a main and booster venturi, main fuel discharge, accelerating pump discharge, idle fuel discharge, and a primary throttle plate.

The two secondary (rear) barrels each have a main and booster venturi, idle fuel discharge, secondary main fuel discharge, and a vacuum operated throttle plate.

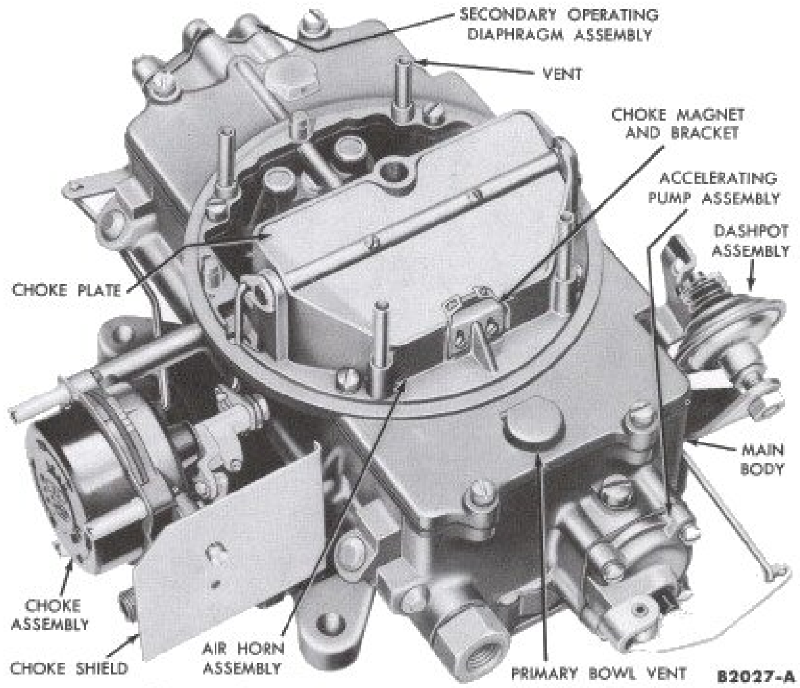


FIG. 1—Ford 4-Barrel Carburetor—¾ Front View

OPERATION

FUEL INLET SYSTEM

A separate fuel bowl is provided for the primary and secondary stages (Fig. 4). The fuel first enters the primary fuel bowl through the fuel inlet. A drilled passage through the right side of the main body connects the fuel bowls. The pressure in the two fuel bowls is balanced by means of a pressure equalizing chamber built into the left side of the main body. Two baffles in the internal fuel equalizer passage between the primary and secondary fuel bowls permit proper control and balance of the metering forces within each fuel bowl.

The amount of fuel entering the fuel bowl is regulated by the distance the fuel inlet needle is raised off its seat and by fuel pump pressure. Movement of the fuel inlet needle in relation to the seat is controlled by the float and lever assembly which rises and falls with the fuel level. When the fuel in the fuel bowl reaches a pre-set level, the float lowers the fuel inlet needle to a position where it restricts the flow of fuel, admitting only enough fuel to replace that being used.

A retracting clip is attached to the fuel inlet needle and hooks over the tab of the float assembly. This clip assures reaction of the fuel inlet needle to any movement of the float.

An integral anti-splash washer is located on top of each fuel inlet needle.

A wire-type retainer prevents movement of the float shaft within the guides on each side of the fuel bowl. The retainer fits into a groove on the inlet needle seat. The ends of the retainer are hooked over grooves on opposite ends of the float shaft.

A torsion (damper) spring is located on the float shaft, between the inboard end of the float retainer and the float shaft guide in the fuel bowl. The short end of the spring rests under the float lever, and the long end of the spring rests against the inner face of the fuel bowl.

The torsion spring tension resists and absorbs fuel pump pressure pulsations and movement of the fuel in the bowl due to driving conditions. This assures proper regulation of the fuel inlet needle which rises and falls with the fuel level in the bowl.

The primary and secondary fuel bowls are vented externally at all times. In addition, both the primary and secondary fuel bowls are internally vented into the air cleaner. The standpipe pitot tubes in the primary and secondary internal vent tube openings raise the level of the internal vent openings above the external vent openings. This provides the necessary pressure differential

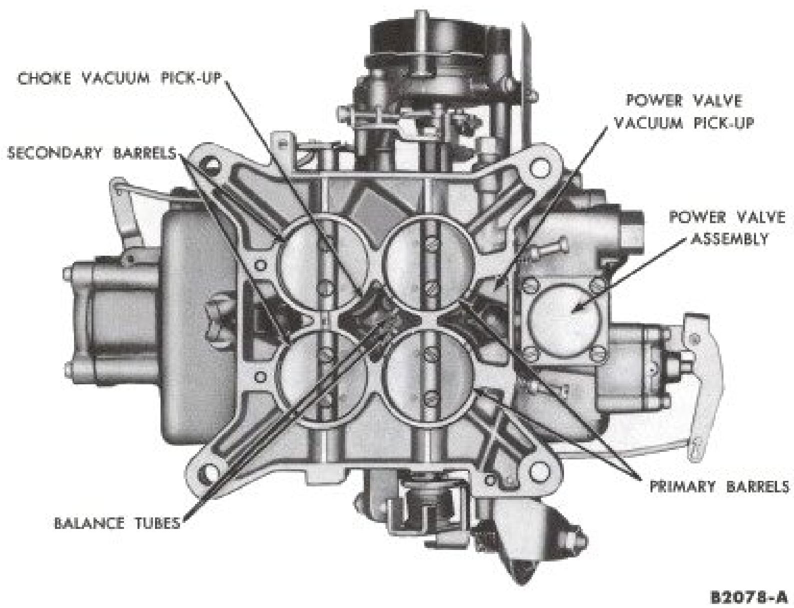


FIG. 2—Ford 4-Barrel Carburetor—Bottom View

for proper evacuation of the gaseous vapors through the external vent during a hot soak period.

AUTOMATIC CHOKE SYSTEM

The choke plate, located in the air horn above the primary barrels, when closed, provides a high vacuum above as well as below the throttle plates. With a vacuum above the throttle plates, fuel will flow from the main fuel system as well as from the idle fuel system. This provides the extremely rich fuel mixture necessary for cold engine operation.

The carburetor choke shaft is linked to a thermostatic choke control mechanism mounted on the main body (Fig. 5).

The bi-metal thermostatic spring mechanism unwinds when cold and winds up when warm. When the engine is cold, the thermostatic spring, through attaching linkage, holds the choke plate in a closed position. When the engine is started, enough air is drawn around the choke plate to enable the engine to operate and prevent flooding.

As the engine continues to operate, manifold vacuum, channeled through a passage on the bottom of the main body to the choke housing, draws heated air from the exhaust manifold heat chamber. The amount of air entering the choke housing is controlled by restrictions in the air passages in the carburetor.

The warmed air and heat radiated from the attached heater hose enters the choke housing and heats the thermostatic spring causing it to wind up. The tension of the thermostatic spring gradually decreases as the temperature of the air from the heat chamber rises, allowing the choke plate to open. The air is exhausted into the intake manifold.

When the engine reaches its normal operating temperature, the spring exerts tension on the choke plate forcing it to the full open position.

During the warm-up period, if the engine should reach the stall point due to a lean mixture, manifold vacuum will drop considerably. The tension of the torsion spring then overcomes the lowered vacuum and air velocity acting on the choke plate. The choke plate will be moved toward the closed position, providing a richer mixture to help prevent stalling.

The fast idle cam pick-up rod actuates the fast idle cam during choking. One edge of the fast idle cam contacts the fast idle adjusting screw which permits a faster engine idle speed for smoother running when the engine is cold. As the choke plate is moved through its range of travel from the closed to the open position, the pick-up lever rotates the fast idle cam. Each position on the fast idle cam permits a slower idle rpm as engine temperature rises and choking is reduced.

The linkage between the choke lever and the throttle shaft is designed so that the choke plate will partially open when the accelerator pedal is fully depressed. This permits unloading of a flooded engine.

IDLE FUEL SYSTEM

The difference in pressure between the fuel bowls and the idle discharge ports forces fuel through the primary and secondary stage idle fuel

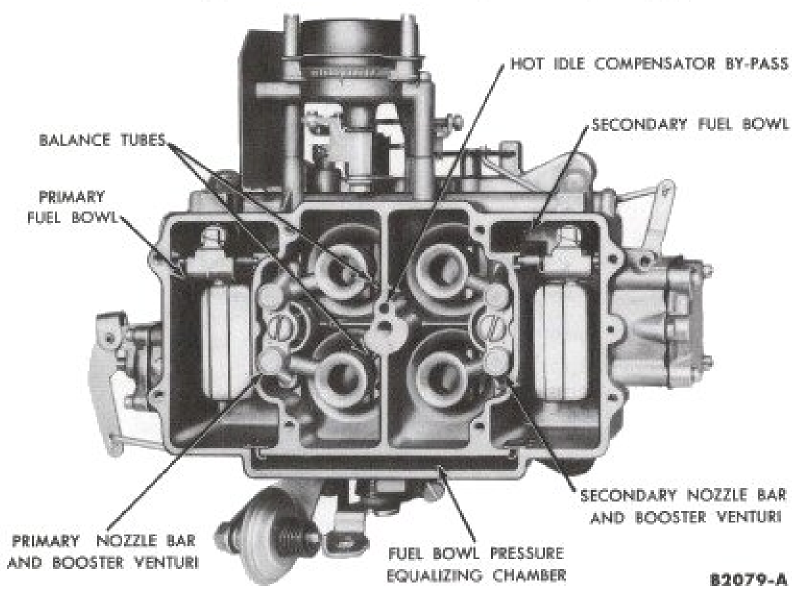


FIG. 3—Ford 4-Barrel Carburetor—Top View

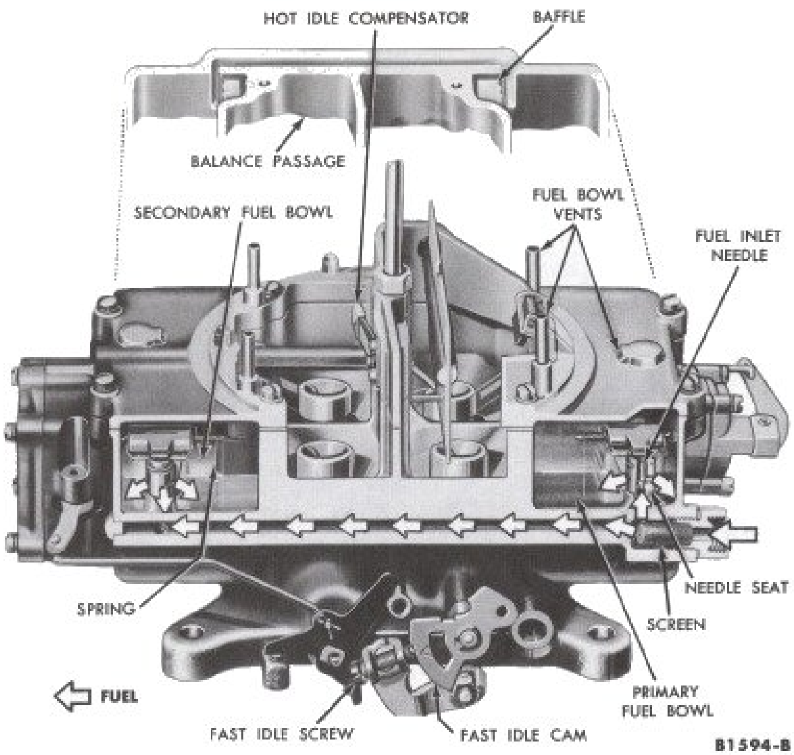


FIG. 4—Fuel Inlet System

systems.

Primary Stage. Fuel flows from the primary stage fuel bowl through the main jet and into the bottom of the main well (Fig. 6).

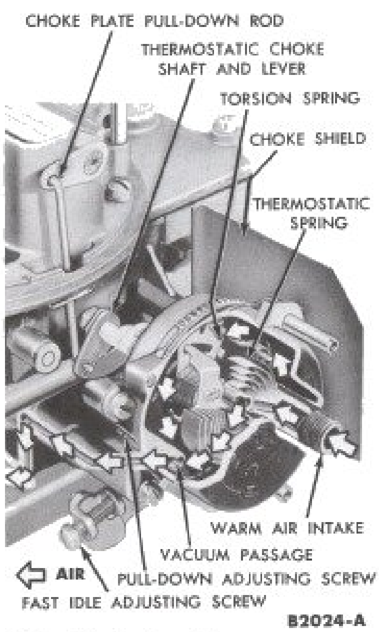


FIG. 5—Automatic Choke System

From the main well, the fuel flows up through the idle tube and through a short diagonal passage in the booster venturi assembly into the idle passage in the main body. A calibrated restriction, at the upper tip of the idle tube, meters the flow of fuel.

Air enters the system from the air bleed which is located directly above the idle tube. The air bleed also acts as a vent to prevent siphoning at off-idle or high speeds and when the engine is stopped. The fuel and air pass down a diagonal passage in the booster venturi and through a calibrated restrictor. Additional air is bled into the system through an air bleed located at the bottom of the diagonal passage where the fuel enters the idle passage in the main body.

Fuel flows down the idle passage in the main body past two idle transfer holes. The idle transfer holes act as additional air bleeds at curb idle. The fuel then flows past the pointed tip of the adjusting needle which controls the idle fuel discharge in the primary stage. From the adjusting needle chamber, the fuel flows through a short horizontal passage and is discharged below the primary throttle plates.

During off-idle when the primary throttle plate is moved slightly past the idle transfer holes, each hole begins discharging fuel as it is exposed to manifold vacuum. As the primary throttle plate is opened still wider and engine speed increases, the air flow through the carburetor is also increased. This creates a vacuum in the booster venturi strong enough to bring the primary stage main fuel system into operation. Fuel flow from the primary idle fuel system begins discharging fuel.

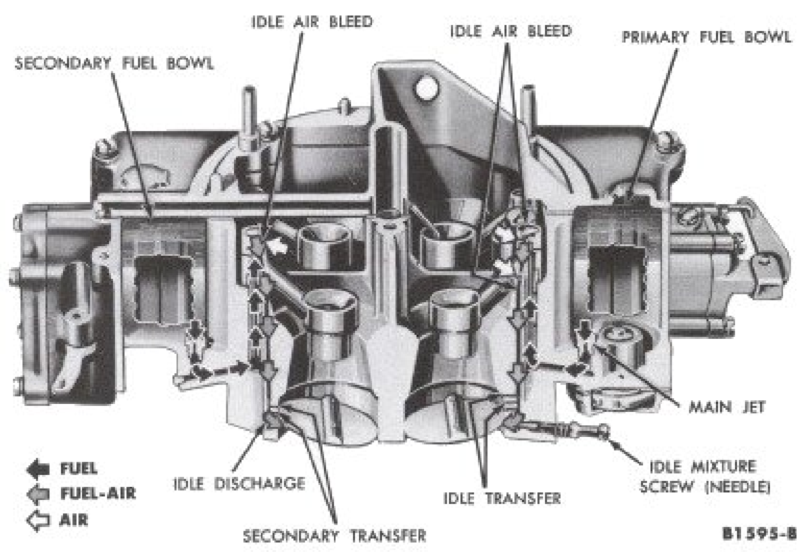


FIG. 6—Idle Fuel System

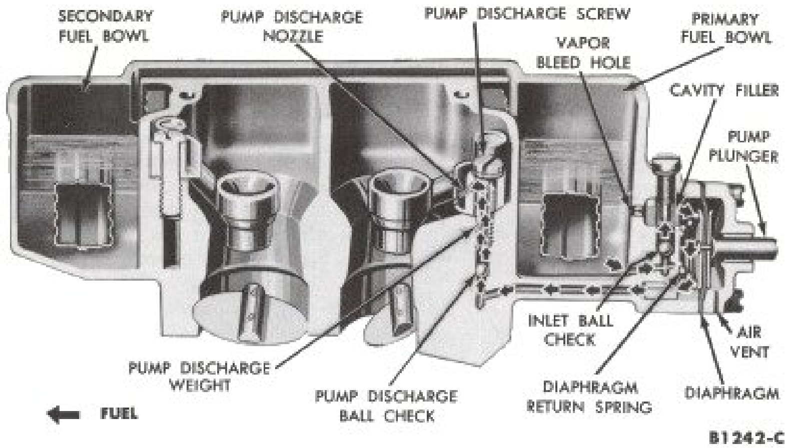


FIG. 7—Accelerating System

Secondary Stage. Fuel flows from the secondary stage fuel bowl through the main jet and into the bottom of the main well (Fig. 6).

From the main well, the fuel flows up through the idle tube and through a short diagonal passage in the booster venturi assembly and then into the idle passage in the main body. A calibrated restriction, at the upper tip of the tube, meters the flow of fuel.

Fuel flows down the idle passage in the main body past two transfer holes above the closed throttle plate and flows through a metered restriction into a short horizontal passage and is discharged into the secondary barrel below the closed throttle plate. The transfer holes act as air bleeds at idle. The secondary idle fuel system continues discharging fuel until the secondary main fuel system comes into operation.

Air is introduced into the secondary stage idle fuel system from the idle air bleed which is located directly above the idle tube. The air bleed also acts as a vent to prevent siphoning in the idle fuel system at high speeds and when the engine is stopped.

ACCELERATING SYSTEM

Upon acceleration, the air flow through the carburetor responds almost immediately to the increased throttle opening. There is, however, a brief interval before the fuel, which is heavier than air, can gain speed and maintain the desired balance of fuel and air. During this interval, the accelerating system (Fig. 7) supplies fuel until the other systems can once again provide the proper mixture.

When the throttle is closed, the diaphragm return spring forces the diaphragm toward the cover, drawing fuel into the chamber through the inlet. The inlet has a ball check which opens to admit fuel from the primary fuel bowl and closes when the accelerating pump is operated to prevent a reverse flow. A discharge weight and ball check prevent air from entering when fuel is drawn into the chamber.

When the throttle is opened, the diaphragm rod is forced inward, forcing fuel from the chamber into the discharge passage. Fuel under pressure forces the pump discharge weight and ball off their seat and fuel passes through the accelerating pump discharge screw and is sprayed into each primary booster venturi through discharge ports.

An air bleed in the wall of the accelerating pump fuel chamber prevents siphoning of fuel when the accelerating pump is not operating.

PRIMARY STAGE MAIN FUEL SYSTEM

As engine speed increases, the air passing through the booster venturi creates a vacuum. The amount of vacuum is determined by the air flow through the venturi, which in turn is regulated by the speed of the engine. The difference in pressure between the main discharge port and the fuel bowl causes fuel to flow through the main fuel system (Fig. 8).

At a predetermined venturi vacuum, fuel flows from the primary fuel bowl, through the main jets, and into the bottom of the main well. The fuel moves up the main well tube past air bleed holes. Filtered air from the high speed air bleed enters the fuel flow in the main well tube

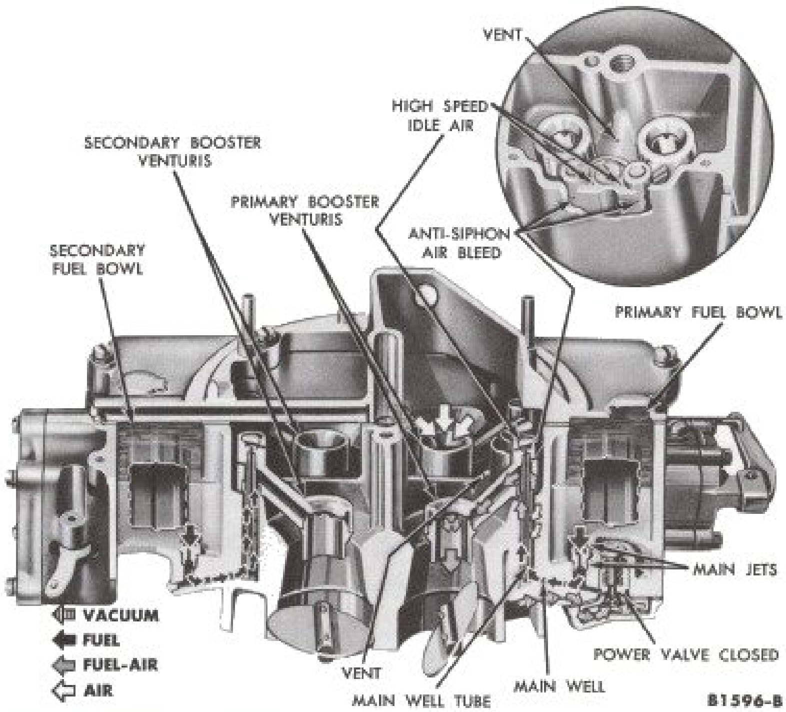


FIG. 8—Primary Stage Main Fuel System

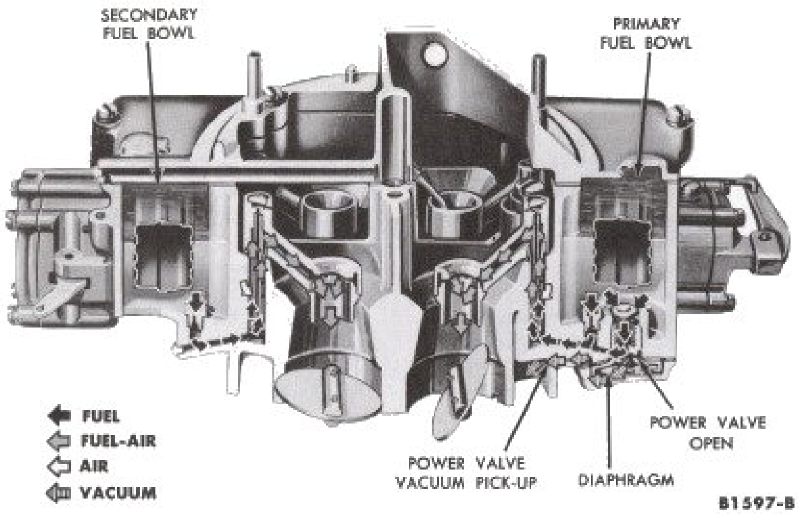


FIG. 9—Power Fuel System

through holes in the side of the tube. The high speed air bleed meters an increasing amount of air to the fuel as venturi vacuum increases, maintaining the required fuel-air ratio. The mixture of fuel and air is lighter than raw fuel and responds faster to changes in venturi vacuum. It also vaporizes more readily than raw fuel. The fuel and air continue up the main well tube past another air bleed which also acts as a vent to prevent siphoning when the engine is shut down. The fuel is discharged into the booster venturi where it is vaporized and mixed with the air flowing through the carburetor.

The throttle plate controls the amount of the fuel-air mixture admitted to the intake manifold, regulating the speed and power output of the engine.

A balance tube is located in each primary barrel directly below the booster venturi. When decelerating, the balance tube siphons off any excess fuel droplets remaining around the edge of the booster venturi and discharges the droplets into the equalizing slots in the base of the carburetor where they are mixed with the idle fuel. The balance tube also acts as an additional air bleed during the idle fuel system operation.

POWER FUEL SYSTEM

During periods of increased road loads or high speed operation, the fuel-air ratio must be increased for added power. The added fuel required during this period is supplied by the power fuel system (Fig. 9).

The power fuel system is controlled by manifold vacuum.

Manifold vacuum is transmitted from an opening in the base of the main body, through a passage in the main body and power valve chamber to power valve diaphragm. The manifold vacuum, acting on the power valve at idle speed or normal road load conditions, is great enough to hold the power valve diaphragm down, overcoming the tension of the spring on the valve stem and holding the valve closed. When high power operation places a greater load on the engine and manifold vacuum drops below a predetermined value, the spring opens the power valve. Fuel from the primary fuel bowl flows through the power valve and into passages leading to both primary stage main fuel wells. Here the fuel is added to the fuel from the primary stage main fuel system, enriching the mixture.

As engine power demands are reduced, manifold vacuum increases. The increased vacuum overcomes the tension of the valve stem spring and closes the power valve.

SECONDARY THROTTLE OPERATION AND MAIN FUEL SYSTEM

To provide sufficient fuel-air mixture to operate the engine at maximum power, the power supplied by the primary stage is supplemented by an additional quantity of fuel-air mixture from the secondary stage (Fig. 10).

This additional supply of fuel-air mixture is delivered through the two secondary (rear) barrels of the carburetor. The secondary stage throttle plates are operated by a spring-loaded vacuum diaphragm assembly attached to the main body and linked to the secondary throttle shaft.

Opening of the secondary throttle plates is controlled by vacuum from

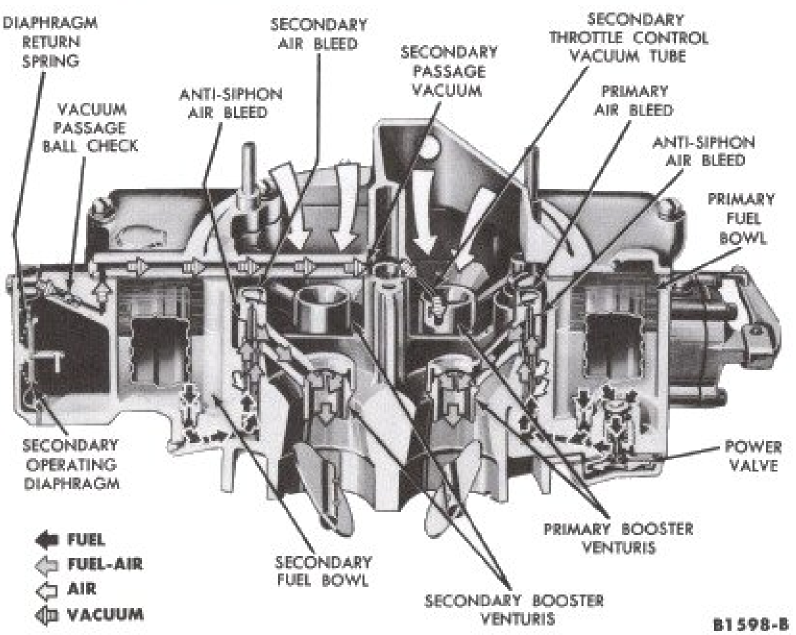


FIG. 10—Secondary Stage Main Fuel System

the left primary booster venturi. The vacuum is transmitted from the secondary throttle control vacuum tube through passages in the air horn, main body, and behind the secondary operating diaphragm.

As the primary throttle plates are opened, primary venturi vacuum increases. When the vacuum reaches a predetermined amount, it starts to act on the secondary stage operating diaphragm, which in turn starts to open the secondary throttle plates.

A ball check, located in the vacuum passage in the diaphragm housing, controls the rate at which the secondary throttle plates are allowed to open. Any rapid increase in vacuum which would tend to open the secondary throttle plates too suddenly holds the ball check against its seat. The opening of the secondary throttle plates is slowed to a rate governed by the amount of vacuum passing through a bleed in the ball seat.

As the secondary throttle plates begin to open, fuel flows from the secondary fuel bowl through the secondary main jets into the bottom of the main well and up the main well tube past air bleed holes. Air is introduced through an air bleed at the top of the tube. When the secondary throttle plates are moved slightly past the secondary transfer holes, each hole begins discharging fuel as it is exposed to manifold vacuum. As secondary venturi vacuum is increased, the fuel is discharged into the secondary booster venturi. Fuel from the transfer holes tapers off and the holes act as additional air bleeds.

When decelerating, vacuum in the primary venturi decreases, and the secondary throttle plates begin to close. The ball check in the diaphragm housing passage will unseat when the throttle is closed quickly, allowing the low pressure on the vacuum side of the diaphragm to rapidly return to atmospheric pressure. As the vacuum acting on the diaphragm is lessened, the load on the diaphragm spring will start closing the secondary plates.

2 IN-CAR ADJUSTMENTS AND REPAIRS

The fuel level float adjustment (dry) and the secondary throttle plate adjustment are performed only as bench adjustments (Part 10-1).

The choke plate clearance (pull-down) and fast idle cam linkage adjustment, the choke magnet and bracket adjustment, the automatic choke thermostatic spring housing adjustment, and the accelerating pump stroke adjustment can be performed with the carburetor on the bench or installed in the car.

FUEL LEVEL FLOAT ADJUSTMENT—WET

The dry (bench) float fuel level settings are preliminary adjustments performed during carburetor overhaul procedures on the bench. These settings are used as a guide only; therefore, a final check and adjustment of the wet fuel level should be made as follows:

1. Operate the engine for 30 minutes at 1200 rpm to normalize engine temperatures, and place the car on a flat surface as near level as possible. Stop the engine.

2. Remove the air cleaner assembly, carburetor air horn assembly, and gasket.

3. Temporarily place the air horn gasket in position on the carburetor main body and start the engine. Let the engine idle for several minutes, then remove the air horn gasket.

4. While the engine is idling, use a standard depth scale to measure the vertical distance from the top machined surface of the carburetor main body to the level of the fuel in the fuel bowl (Fig. 11). The measurement must be made at least ¼ inch away from any vertical surface to assure an accurate reading, because the surface of the fuel is concave (higher at the edges than in the center). Care must be exercised to measure the fuel level at the point of contact with the fuel. Refer to the specifications for the correct fuel level (wet) setting.

5. If any adjustment is required, stop the engine to minimize the hazard of fire due to fuel spray when the float setting is disturbed. To adjust the fuel level, bend the float tab (contacting the fuel inlet valve) upward in relation to the original position to raise the fuel level, and downward to lower it. Each time an adjustment is made to the float tab to alter the fuel level, the engine must be started and permitted to idle for at least three minutes to stabilize the fuel level. Check the fuel level after each adjustment until the specified level is achieved.

6. Install the new air horn gasket and the carburetor air horn assembly.

7. Check the idle fuel mixture and idle speed adjustment. Adjust the carburetor as required.

8. Install the air cleaner assembly.

CHOKE MAGNET AND BRACKET ADJUSTMENT

1. Remove the air cleaner assembly. Remove the bracket retaining the heater hose against the automatic choke thermostatic spring housing.

2. Rotate the thermostatic spring housing 90° in the "rich" direction (counterclockwise).

3. Place a 0.010 inch feeler gauge, or wire between the downward (front) side of the choke plate and the air horn wall (Fig. 12).

4. Loosen the magnet bracket retaining screws and adjust the magnet to just contact the choke plate. Tighten the retaining screws and remove the feeler gauge. Stake the retaining screws.

5. If the choke plate clearance (pull-down) and fast idle cam linkage adjustment is not required, set the thermostatic coil housing to the specified index mark and tighten the retaining clamp screws.

6. Install the heater hose and bracket on the carburetor and tighten the bracket retaining screws.

7. Install the air cleaner assembly.

AUTOMATIC CHOKE PLATE CLEARANCE (PULL-DOWN) AND FAST IDLE CAM LINKAGE ADJUSTMENT

1. If the heater hose and mounting bracket, and the air cleaner assembly have not been previously removed, remove them from the carburetor.

2. Rotate the choke thermostatic spring housing 90° in the "rich" direction (counterclockwise).

3. Open the throttle plates so the fast idle screw does not contact the fast idle cam.

4. Depress the downward (front)

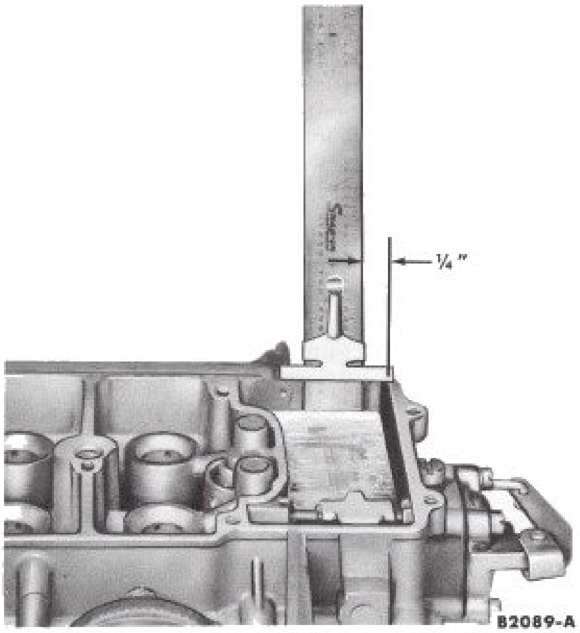


FIG. 11—Fuel Level Float Adjustment—Wet

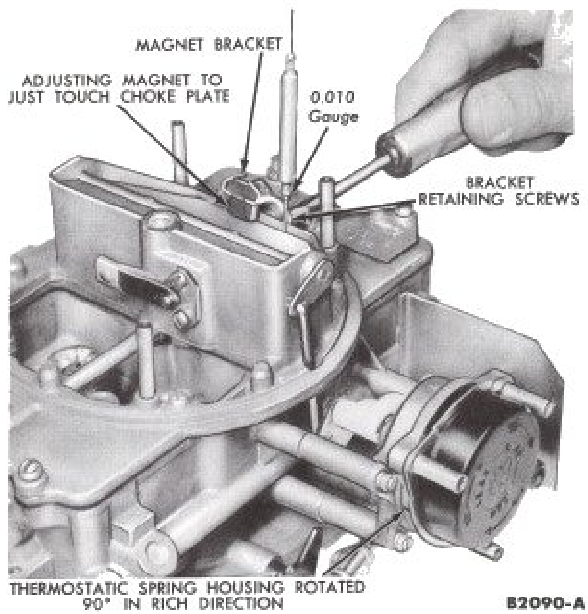


FIG. 12—Magnet and Bracket Adjustment

side of the choke plate lightly until resistance is felt. **The clearance between the downward side of the choke plate and the air horn wall is the choke plate pull-down clearance** (Fig. 13). Check the clearance by placing a gauge or the shank end of a drill of the specified clearance dimension between the downward (front) edge of the choke plate and the air horn wall (Fig. 13).

If the choke plate clearance is not within specification, turn the pull-down adjusting screw (Fig. 13) clockwise (inward) to increase the clearance, or counterclockwise (outward) to decrease the clearance.

5. Set the fast idle (rpm) adjusting screw on the kickdown step of the fast idle cam. Check the clearance dimension between the downward (front) edge of the choke plate and the air horn wall. If the clearance is not within specification, turn the over-travel lever adjusting screw (Fig. 14) clockwise (inward) to increase the clearance, or counter-

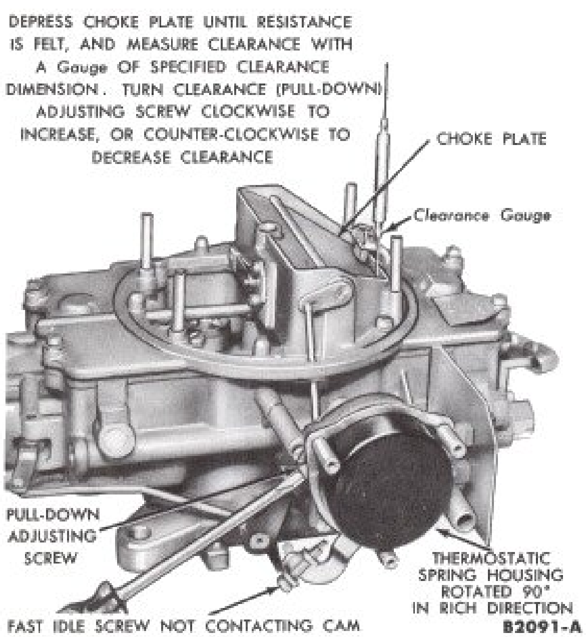


FIG. 13—Choke Plate Clearance (Pull-Down) Adjustment

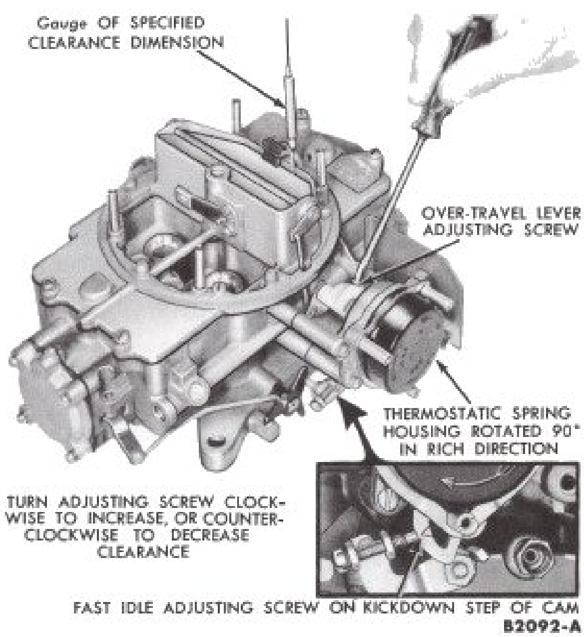


FIG. 14—Fast Idle Cam Linkage Adjustment

clockwise (outward) to decrease the clearance.

6. Set the choke thermostatic coil housing to the specified index mark and tighten the clamp retaining screws.

7. Install the heater hose and mounting bracket on the carburetor and tighten the retaining screws.

8. Adjust the engine idle speed and idle fuel mixture, if necessary.

9. Install the air cleaner.

AUTOMATIC CHOKE THERMOSTATIC SPRING HOUSING ADJUSTMENT

1. If the heater hose and mounting bracket, and the carburetor air cleaner assembly have not been previously removed, remove them from the carburetor.

2. Loosen the thermostatic spring housing clamp retaining screws. Set the spring housing to the specified index mark (Fig. 15) and tighten the clamp retaining screws.

3. Install the heater hose and bracket on the carburetor and tighten the bracket retaining screws. If other carburetor adjustments are not required, install the carburetor air cleaner assembly.

IDLE FUEL MIXTURE AND IDLE SPEED ADJUSTMENTS

The engine idle speed is adjusted to settings for a hot engine, and a cold engine (fast idle speed) during choke operation. With the air cleaner removed make the idle adjustments in the following sequence:

INITIAL IDLE MIXTURE SETTING

Initially set the idle mixture by turning the idle mixture screws (needles) inward (clockwise) until lightly seated; then, turn the screws outward (counterclockwise) 1-1½ turns (Fig. 16). **Do not turn the needles tightly against their seats as this may groove the ends. If the needle is damaged, it must be replaced before a satisfactory fuel mixture can be obtained.**

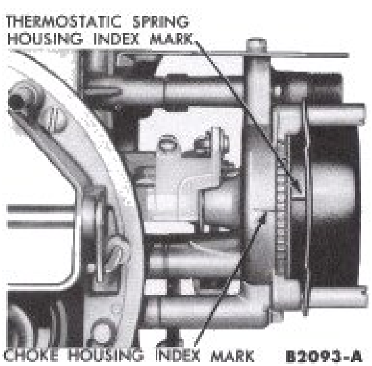


FIG. 15–Automatic Choke Thermostatic Spring Housing Adjustment

ENGINE IDLE SPEED AND MIXTURE (HOT)

1. Operate the engine for three minutes at approximately 1200 rpm to stabilize engine temperatures. **On a car with an air conditioner, operate the air conditioner for 20 minutes before setting the engine idle speed. The engine idle speed is adjusted with the air conditioner operating.**

2. Allow the throttle to drop back to the normal idle speed position. Attach a tachometer to the engine. **Set the parking brake.**

3. Place the transmission selector lever in drive range. Check the engine idle speed. **Be sure the dashpot is not interfering with the throttle lever or the fast idle screw is not contacting the fast idle cam.**

4. Adjust the engine idle speed to drive range specifications by turning the engine idle speed screw inward to increase the speed or outward to decrease the speed (Fig. 17).

5. Turn each idle mixture needle inward until engine rpm begins to drop, due to the lean mixture (Fig. 17); then turn each needle outward until the rpm increases and then begins to drop, due to the rich mixture, then turn the needles inward for maximum engine rpm and smoothness. **The needles should be turned approximately the same amount. The final setting may vary about ½ turn difference between needles.**

6. After the correct engine idle mixture has been obtained, check the idle speed by placing **the transmission selector lever in neutral and manually opening and closing the throttle.** Position the selector lever in drive range, then check and adjust the idle speed, if necessary. Shut off the engine.

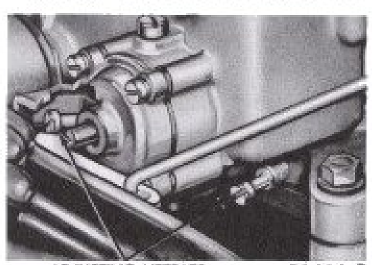


FIG. 16–Idle Fuel Mixture Adjustment

The final engine idle speed may be varied to suit the conditions under which the car is to be operated.

ENGINE FAST (COLD) IDLE SPEED

The adjusting screw on the right side of the carburetor (Fig. 18) contacts one edge of the fast idle cam. The cam permits a faster engine idle speed for smoother running when the engine is cold during choke operation. As the choke plate is moved through its range of travel from the closed to the open position, the fast idle cam pick-up lever rotates the fast idle cam. Each position on the fast idle cam permits a slower idle rpm as engine temperature rises and choking is reduced.

1. Manually rotate the fast idle cam until the fast idle adjusting screw rests (Fig. 18), adjacent to the shoulder of the highest step (align screw with arrow mark on the cam).

2. Start the engine, and turn the fast idle adjusting screw inward or outward as required to obtain the specified fast idle rpm.

3. Remove the tachometer if the idle fuel mixture does not require adjustment. If the idle fuel mixture requires adjustment, leave the tachometer installed so that the idle speed can be checked after the idle fuel mixture has been adjusted.

ACCELERATING PUMP STROKE

The over-travel lever has four holes and the accelerating pump link has two holes (Fig. 17) to control the accelerating pump stroke for various ambient temperatures and operating conditions of the engine.

The accelerating pump stroke adjustment is made with the carburetor air cleaner assembly removed from the carburetor.

For average ambient temperature operation (40° to 80° F.) place the accelerating pump operating rod in the No. 3 hole (third hole from the throttle shaft) position of the over-travel lever (Fig. 17). To release the rod from the retainer clip, press the tab ends of the clip together; then,

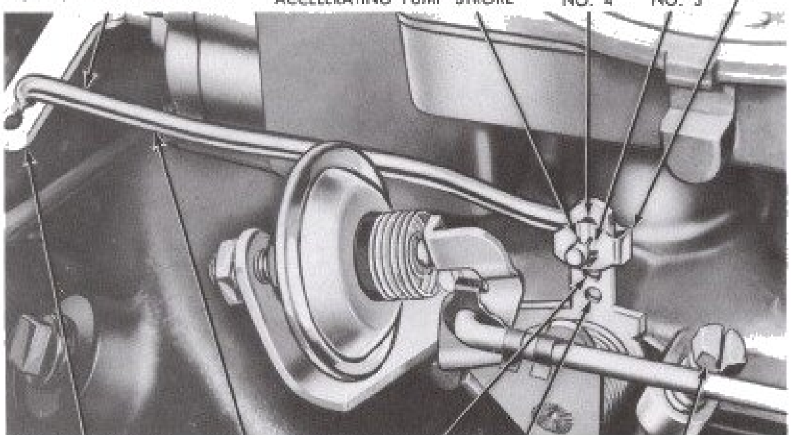


FIG. 17—Accelerating Pump Stroke and Idle Speed Adjustment

at the same time, press the rod away from the clip until it is disengaged.

For low ambient temperature operation (below 40° F.) place the pump operating rod in the No. 4 hole (fourth hole from the throttle shaft) position of the over-travel lever.

For high ambient temperature operation (above 80° F. and/or above 5000 feet altitude) the pump operating rod may be placed in the No. 2 hole (second hole from the throttle shaft) of the over-travel lever to suit individual operating conditions.

The correct position for the pump operating rod at the accelerating pump link (Fig. 17) for all operating conditions is in the inboard hole (hole closest to the pump plunger).

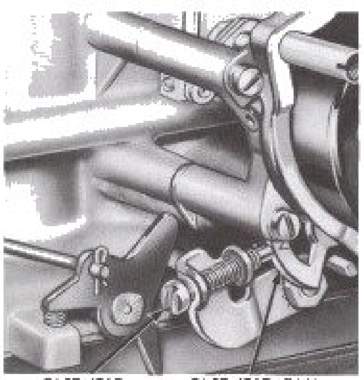


FIG. 18—Engine Fast (Cold Engine) Idle Speed Adjustment

ANTI-STALL DASHPOT

1. The anti-stall dashpot adjustment is made with the carburetor air cleaner assembly removed from the carburetor. With the engine idle speed and idle mixture properly adjusted, and the engine at normal operating temperature, loosen the anti-stall dashpot lock nut (Fig. 19).

2. Hold the throttle in the closed position and depress the plunger with a screwdriver blade. Check the clearance between the throttle lever and the plunger tip with a feeler gauge of the specified clearance dimension. Turn the anti-stall dashpot, in its bracket, in a direction to provide the specified clearance between the tip of the plunger and the throttle lever. Tighten the lock nut to secure the adjustment.

3. Place the transmission in neutral, and turn off the engine.

AUTOMATIC CHOKE TORSION SPRING ADJUSTMENT

The adjustment of the choke torsion spring (Fig. 20) should only be made after it is assured that all other carburetor adjustments are within specifications.

The normal position for the short tang of the choke housing spring is on the center prong of the choke housing shaft lever assembly (Fig. 20). The two remaining prong positions are intended for increasing or decreasing the spring tension to correct for an apparent lean mixture or rich mixture in the automatic choke system during driveaway immediately after a cold start in low ambient temperatures. Engine hesitation or stumble indicates a lean mixture. An engine that runs rough (lopes or gallops) indicates a rich mixture. Decrease the spring tension to correct for richness. Increase the tension to correct for leanness.

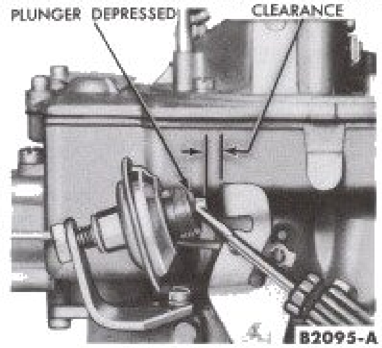


FIG. 19—Anti-Stall Dashpot Adjustment

1. Remove the carburetor air cleaner assembly. Remove the thermostatic spring housing.

2. Place the short tang of the spring in the left prong to increase tension, the center prong for normal operation, or the right prong to decrease tension (Fig. 20).

3. Install the thermostatic spring housing and set it at the specified index mark; then, tighten the retaining screws. Install the heater hose and mounting bracket on the carburetor. Install the carburetor air cleaner assembly.

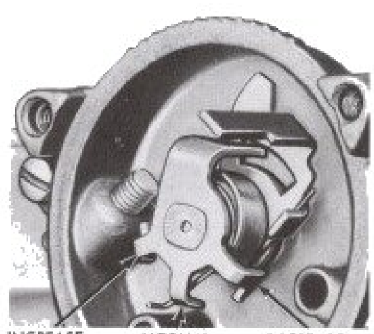


FIG. 20—Torsion Spring Adjustment

THROTTLE LINKAGE

MANUAL-SHIFT TRANSMISSION

1. Adjust the engine idle speed to specification.
2. Check the accelerator pedal height (Fig. 21). To adjust the pedal height, disconnect the carburetor connecting rod. Lengthen or shorten the accelerator connecting link to obtain the specified accelerator pedal height.
3. With the throttle lever against the idle adjusting screw, adjust the carburetor connecting rod until the end of the rod has a free fit into the carburetor throttle lever hole.

OVERDRIVE TRANSMISSION

1. Adjust the engine idle speed, pedal height and throttle linkage as outlined under "Manual Shift Transmission", Steps 1 through 3.
2. With the accelerator shaft (Fig. 21) held in the full throttle position, slide the overdrive control switch up or down on the elongated slots until the accelerator shaft is just touching the switch plunger. If the switch does not touch the shaft when it is in its closed position, an adjustment, not exceeding four turns counterclockwise, may be made at the switch plunger.
3. Return the accelerator shaft to its normal position. Turn the switch plunger five turns counterclockwise to adjust for kickdown operation.

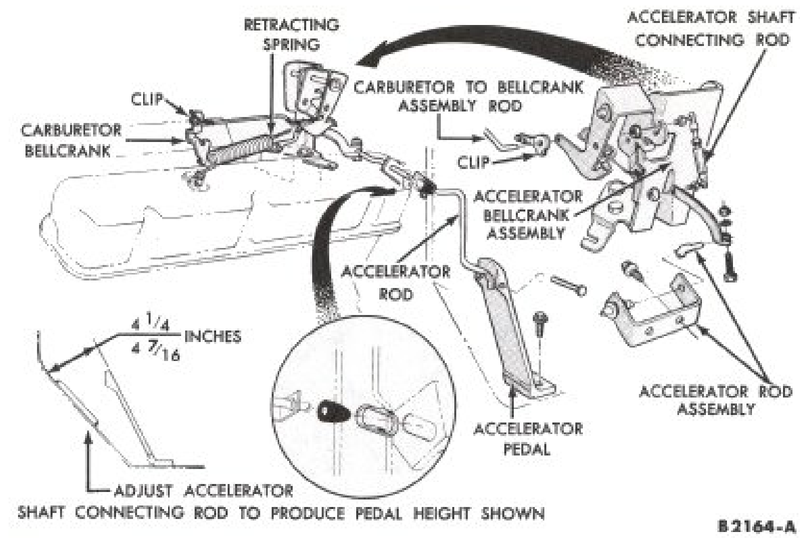


FIG. 21—Throttle Linkage—V-8 Engine

AUTOMATIC TRANSMISSION

The throttle linkage adjustments for the automatic transmission are covered in Group 7.

3 REMOVAL AND INSTALLATION

REMOVAL

Flooding, stumble on acceleration, and other performance complaints are, in main instances, caused by the pressure of dirt, water, or other foreign matter in the carburetor. To aid in diagnosing the cause of a complaint, the carburetor should be carefully removed from the engine without removing the fuel from the bowls. The contents of the bowls may then be examined for contamination as the carburetor is is disassembled.

1. Remove the air cleaner. Remove the bracket that secures the heater hose to the automatic choke. Remove the throttle rod from the throttle lever. Disconnect the distributor vacuum line, the fuel inlet line, and the choke heat tube at the carburetor.
2. Remove the carburetor retaining nuts and lock washers; then remove the carburetor. Remove the spacer gasket from the spacer. **Whenever the carburetor is removed from the engine, care must be exercised to prevent damage to the throttle plates. The lower edges of the throttle plates project below the carburetor body whenever they are open.**

INSTALLATION

1. Clean the gasket surface of the spacer and carburetor. Place the new gasket on the spacer. Position the carburetor on the spacer. To prevent leakage, distortion, or damage to the carburetor body flange, snug the nuts; then, alternately tighten each nut in a criss-cross pattern to the specified torque.
2. Connect the throttle rod, the choke heat tube, the fuel inlet line, and the distributor vacuum line. Refer to "In-Car Adjustments and Repairs" (Part 10-4) and adjust the accelerating pump stroke, the idle fuel mixture and idle speed, and the anti-stall dashpot. Install the air cleaner.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

To facilitate working on the carburetor and to prevent damage to the throttle plates, install carburetor legs on the base. If legs are unavailable, install four bolts (about 2¼ inches long of the correct diameter), and nuts on the carburetor base.

Use a separate container for the component parts of the various assemblies to facilitate cleaning, inspection, and assembly.

For a complete carburetor overhaul, follow all the steps. To partially overhaul the carburetor or to install a new gasket kit, follow only the applicable steps.

Refer to Fig. 24 for parts identification.

AIR HORN

1. Remove the air cleaner anchor screw and lock washer.
2. Remove the choke plate rod hairpin retainer.
3. Remove the air horn retaining screws and lock washers. Remove the air horn and the choke plate rod. Remove the air horn gasket.
4. Remove the choke plate screws and the choke plate from the choke plate lever. **If the tips of the screws are flared excessively, file off the flared portion to prevent damage to the threads in the shaft.**
5. Rotate the choke plate lever and remove the choke plate rod from the lever. Slide the choke shaft out of the air horn. Slide the felt seal and two washers out of the choke rod seal retainer.
6. If it is necessary to remove the secondary throttle control vacuum tube, pry it out with needle nose pliers. Discard the tube after removal.
7. If it is necessary to replace the choke plate magnet and bracket, remove the staking marks on the retaining screws and remove the choke plate magnet and bracket assembly.

MAIN BODY

1. Using a hook, disconnect the float shaft retainer from each float (Fig. 22). Remove the float and shaft, and the fuel inlet needle assembly from each fuel bowl. Remove the torsion (damper)spring from the shaft.
2. Using a jet wrench, remove the fuel inlet needle seat from each fuel bowl and the primary stage and secondary stage main jets.
3. Remove the primary stage booster venturi assembly and gasket. Invert the main body and let the accelerating pump discharge weight and ball fall into the hand. Remove the fuel inlet fitting, gasket, and screen.
4. Remove the secondary stage booster venturi assembly and gasket.
5. Remove the accelerating pump operating rod retainer, then remove the rod. Remove the accelerating pump cover, diaphragm assembly, and spring. Remove the inlet ball check retainer screw and gasket. Invert the main body and let the accelerating pump inlet ball check fall into the hand. Remove the accelerating pump cavity filler.
6. Remove the secondary diaphragm operating rod. Remove the diaphragm cover, return spring, and diaphragm. The secondary ball check is not removable.
7. Invert the main body and remove the power valve cover and gasket. Using a box wrench, remove the power valve and gasket. Remove the idle fuel adjusting needles and springs.
8. Remove the choke shield. Remove the fast idle cam retainer. Remove the thermostatic spring housing clamp, and gasket.
9. Remove the choke housing and gasket, and the fast idle cam.
10. Remove the choke housing shaft lever retaining nut, spacer, and lever. Slide the fast idle cam over-travel lever off the choke housing shaft.
11. Remove the fast idle cam pick-up rod from the fast idle cam over-travel lever.
12. Remove the retainer from the choke housing shaft and slide the shaft assembly out of the choke housing. Remove the thermostatic spring lever and the torsion spring from the shaft. Remove the nylon liner from the thermostatic spring lever.
13. Remove the nut and washer securing the fast idle adjusting lever assembly to the primary throttle shaft and remove the lever assembly.
14. Remove the distributor vacuum line fitting, the anti-stall dashpot, and the hot engine idle adjusting screw and spring.
15. If it is necessary to remove the throttle plate, lightly scribe the primary and secondary throttle plates along the throttle shafts and mark each plate and its corresponding bore with a number or letter for proper installation (Fig. 23).
16. Slide the primary and secondary throttle shafts out of the main body.
17. Remove the accelerating pump over-travel lever retainer and slide the bushing spring and the lever off the primary throttle shaft.

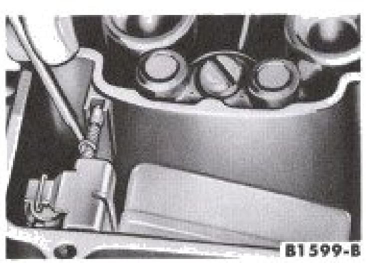


FIG. 22—Float Shaft Retainer Removal or Installation

PARTS REPAIR OR REPLACEMENT

Clean and inspect the carburetor component parts. Refer to "Cleaning and Inspection" (Part 10-1) for the proper procedure. Replace all worn or damaged parts.

ASSEMBLY

Make sure all holes in the new gaskets have been properly punched and that no foreign material has adhered to the gaskets. Make sure the accelerating pump diaphragm and secondary operating diaphragm are not torn or cut. The carburetor assembly is shown in Fig. 24.

AIR HORN

Refer to Fig. 25 for the correct location of the parts.

1. Position the choke plate shaft in the air horn. Place the choke plate rod seal between the two brass washers and slide them in position on the seal retainer. Slide the choke plate rod through the opening in the air horn assembly and position it in the choke shaft lever.
2. Slide the choke plate into the shaft. Close the choke plate and position it in the shaft, then install the screws. Tighten and stake the screws.
3. If necessary, start a new secondary throttle control vacuum tube into the air horn. **Make certain the tube is installed in a manner that will insure that the pick-up end will face downward toward the**

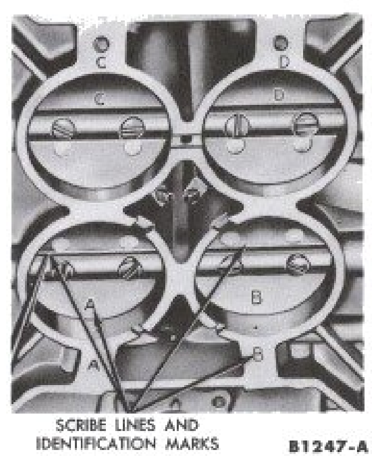


FIG. 23—Throttle Plate Removal

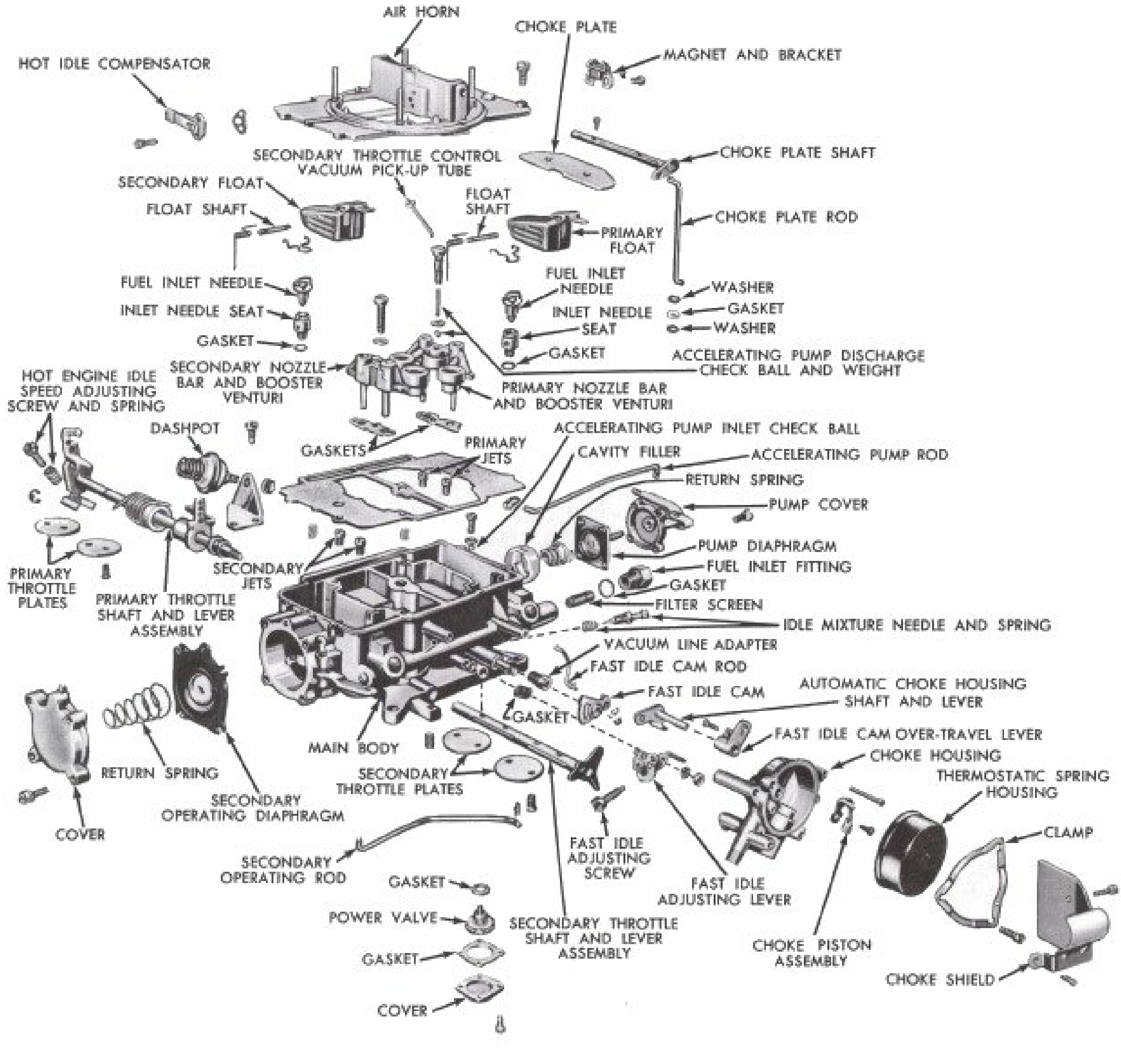


FIG. 24—Ford 4-Barrel Carburetor Assembly

primary booster venturi when the air horn is installed. Drive the tube into the air horn by grasping it lightly below the shoulder with pliers and striking the pliers with a hammer. Drive the tube in until it stops against its shoulder. **Do not crush or bend the tube.**

4. If the choke plate magnet and bracket was removed, install the new magnet and bracket assembly. **Do not stake the screws at this time. Adjust the magnet and bracket after the carburetor is assembled, then stake the screws.**

MAIN BODY

1. If the throttle plates were removed, install the bushing and place the accelerator over-travel spring, with the shortest tang end first, over the boss on the over-travel lever. Place the short tang of the spring under the lug on the lever. Slide the over-travel lever and spring assembly on the throttle shaft and bushing. Hook the longest tang of the spring under the closed throttle lug of the throttle lever (Fig. 26). Install the over-travel lever retainer. Slide the primary throttle shaft assembly into the main body.

Referring to the lines scribed on the throttle plates, install the primary throttle plates in their proper location with the screws snug, but not tight. Invert the main body and hold it up to the light. Little or no light should show between the throttle plates and the throttle bores. Tap the plates lightly with a screwdriver handle to seat them. Tighten and stake the screws.

Slide the secondary shaft into the main body. Referring to the lines scribed on the secondary throttle plates, install the throttle plates in their proper location. To install the plates, follow the procedure given for the primary throttle plates. Adjust the secondary throttle plates (refer to "Carburetor Bench Adjustments" in Part 10-1, Section 2).

2. Install the hot engine idle spring and screw.

3. Install the anti-stall dashpot.

4. Install the distributor vacuum passage fitting. Place the fast idle lever assembly on the primary throttle shaft and install the retaining washer and nut. (Fig. 27). Slide the fast idle cam on the boss on the main body. Do not install the retainer at this time (Fig. 27).

5. Install the torsion spring liner on the hub of the thermostatic spring lever. Position the torsion spring over the liner, then position the thermostatic spring with the long tang against the lug on the lever (Fig. 28). Slide the lever and spring assembly on the choke housing hub with the short tang of the spring resting on the center prong of the lever and the lug on the shaft positioned in the slot in the thermostatic spring lever (Fig. 28). Place the spacer on the choke housing shaft. Slide the assembly into the choke housing (Fig. 28). Install the retaining clip in the groove on the choke plate shaft.

6. Slide the fast idle cam overtravel over the choke housing shaft, with the head of the adjusting screw facing upward and toward the front of the carburetor (Fig. 29).

7. Place the choke housing shaft lever and spacer on the choke housing shaft, with the top of the lever tang located under the fast idle cam lever adjusting screw. Install the retaining nut. Install the fast idle cam pick-up rod and retainer on the fast idle cam over-travel lever. Install the fast idle cam retainer (Fig. 29).

8. Place the gasket on the vacuum pick-up port of the choke housing and install the choke housing on the main body. Insert the fast idle cam pick-up lever into the fast idle cam as the choke housing is positioned into place. Install and tighten the choke housing retaining screws. Install the pick-up lever retainer. Position the thermostatic spring cover gasket on the choke housing. Install the cover on the choke housing and gasket, with the arm of the thermostatic spring lever inserted into the loop of the thermostatic spring. Position the cover retainer over the cover and install the retaining screws.

9. Drop the accelerating pump inlet ball check in the inlet passage of the accelerating pump chamber. Seat the ball check with a brass drift and a light hammer. Make sure the ball is free. Install the accelerating pump cavity filler. Install the washer and ball check retaining screw. Install the diaphragm return spring on the boss in the chamber. Insert the diaphragm assembly in the cover and place the cover and diaphragm assembly in position on the main body. Install the cover screws finger-tight. Push the accelerating pump plunger the full distance of its travel and tighten the cover screws. Install the accelerating pump operating rod. Refer to "In-Car Adjustments and Repairs" (Part 10-4, Section 2), and adjust the accelerating pump stroke.

10. Invert the main body. Using a socket wrench, install the power valve and gasket. **Tighten the power valve securely.** Install the cover and gasket. Install the idle adjusting needles and springs. Turn the needles in gently with the fingers until they just touch the seat, then back them off 1-1½ turns for a preliminary idle adjustment.

11. Install the secondary operating diaphragm on the secondary operating lever. Install the diaphragm return spring on the cover. Install the cover with the screws finger-tight. With the diaphragm in the extended position, tighten the cover screws. Install the secondary diaphragm rod.

12. Using a jet wrench, install the primary main jets and the fuel inlet seat. **Be sure the correct jets are installed.** Position the float shaft retainer in the groove on the fuel inlet needle seat. Install the fuel inlet needle assembly in the fuel inlet seat. **The fuel inlet needle and seat are matched assemblies. Be sure the correct needle and seat are assembled together.** Slide the float shaft into the float lever. Install the damper spring on the float shaft and insert the short end of the spring under the flange of the float lever. Insert the float assembly into the fuel bowl and hook the float tab under the clip on the fuel inlet needle assembly. Insert the float shaft into its guides at the sides of the fuel bowl. Allow the long end of the damper spring

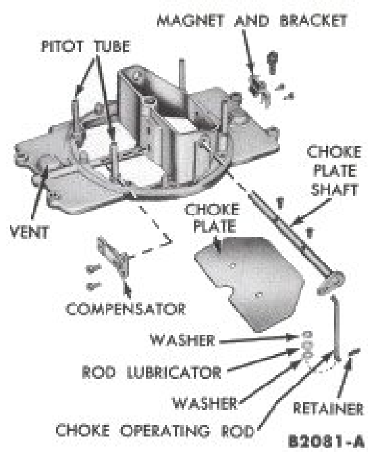


FIG. 25—Air Horn Assembly

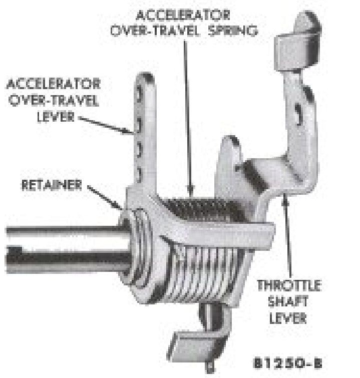


FIG. 26—Accelerator Over-Travel Spring and Lever Installation

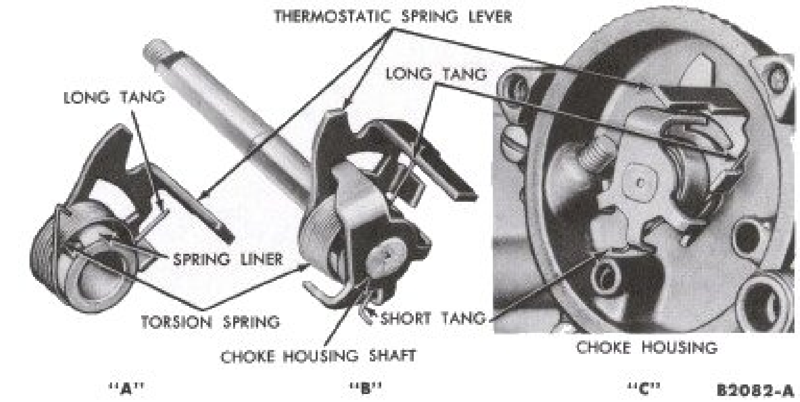


FIG. 28—Choke Housing Torsion Spring Installation

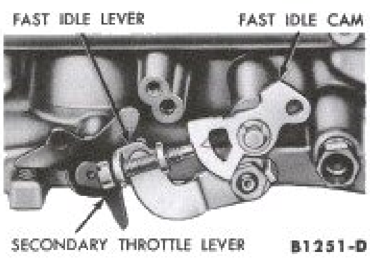


FIG. 27—Fast Idle Cam and Lever Installation

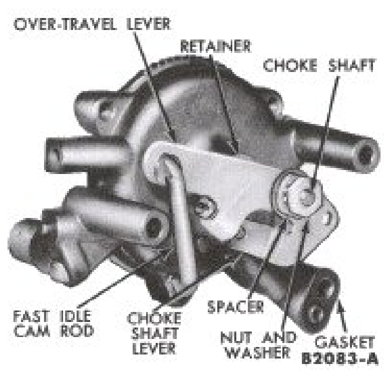


FIG. 29—Choke Linkage Installation

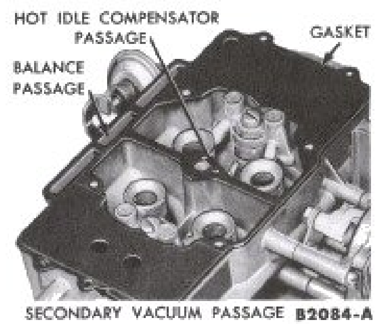


FIG. 30—Main Body Gasket Installation

to rest against the wall of the fuel bowl. Using a hook, position the shaft retainer in the grooves on the shaft. Refer to "Carburetor Bench Adjustments" (Part 10-1, Section 2) and check the float setting.

13. Repeat step 12 on the secondary stage fuel bowl.

14. Drop the accelerating pump discharge ball into its passage in the primary side of the main body. Seat the ball with a brass drift and a light hammer. Make sure the ball is free. Drop the accelerating pump discharge weight on top of the ball. Position the primary booster venturi assembly and gasket in the main body. Install the retaining screw. **The primary booster screw is hollow.** Install the screen, and the fuel inlet fitting and gasket.

15. Position the secondary booster venturi assembly and gasket in the main body and install the gasket and retaining screw.

16. Position the air horn gasket on the main body (Fig. 30). Position the air horn on the main body and gasket so that the choke plate rod fits into the opening in the choke housing lever. Install the choke plate rod retainer. **Use care to prevent damage to the secondary throttle control vacuum tube during the air horn installation.** Install the air horn retaining screws, lock washers and the identification tag.

17. Refer to Part 10-4, Section 2, "In-Car Adjustments and Repairs" and perform the automatic choke plate clearance (pull-down) adjustment, the fast idle cam linkage adjustment, the automatic choke magnet and bracket adjustment and the automatic choke housing adjustment.

BENCH ADJUSTMENTS

All carburetor adjustments except the fuel level float adjustment wet, the idle fuel mixture and idle speed adjustments, the anti-stall dashpot adjustment, and the automatic choke torsion spring adjustment can be made with the carburetor removed from the car. Refer to Part 10, Section 2 for the "Carburetor Bench Adjustments."

PART 10-5 AIR CLEANER

1 DESCRIPTION AND OPERATION

DESCRIPTION

All engines are equipped with a dry-type air cleaner that has a replaceable cellulose fiber filtering element (Fig. 1). On the V-8 engines a tube attached to the filtered air chamber (Fig. 1) is connected to the automatic choke heat chamber to supply clean air to the automatic choke.

HOT AND COLD AIR INTAKE

The V-8 engine is equipped with a thermostatically controlled carburetor air inlet duct assembly.

The air cleaner body is mounted on a sealing gasket located on the carburetor air horn. The air cleaner assembly is retained on the engine by a stud in the carburetor body and a wing nut above the filter cover. The replaceable filter element assembly consists of pleated filter paper encased in a wire mesh screen, with integral plastic gaskets located on the top and bottom of the element. The gaskets prevent entry of dirt and unfiltered air into the engine.

The thermostatically controlled air inlet duct and shroud assembly is attached to the air cleaner body with a wing nut. The shroud is positioned on the left exhaust manifold. The air inlet duct control mechanism, consists of a valve plate, thermostat, adjustable thermostat rod, two springs and a retaining clip.

OPERATION

The air from the engine compartment enters the air cleaner assembly through the opening (horn) on the side of the body, into a silencing chamber and passes through the filter element. Dust particles are trapped in the filter element as the air passes through it. After leaving the filter element, the air is deflected down into the carburetor.

HOT AND COLD AIR INTAKE

The air received from the air duct passes through a silencing chamber in the air cleaner body and then through the filter element. After leaving the filter element, the air is deflected down into the carburetor. Dust particles and other foreign materials are trapped in the filter element as the air rushes through it.

The temperature of the air entering the air cleaner is thermostatically controlled by the carburetor air duct assembly (Fig. 2). Air from the engine compartment, or heated air from a shroud around the exhaust manifold, is available to the engine.

A thermostatic bulb in the air duct is exposed to the incoming air. A spring-loaded valve plate is connected to the thermostatic bulb through linkage. The valve plate spring holds the valve in the closed position (heat on) until the thermostatic bulb overcomes the valve tension.

During the engine warm-up period when the air temperature entering the air duct is less than 75°F, the thermostat is in the retracted position and the valve plate is held in the up position (heat on) by the valve plate spring, thus shutting off the air from the engine compartment (Fig. 2). All air is then drawn from the shroud around the exhaust manifold.

As the temperature of the air passing the thermostatic bulb approaches 85°F, the thermostat starts to expand, and pulls the valve plate down. This allows cooler air from the engine compartment to enter the air cleaner. When the temperature of the air reaches approximately 105°F, the valve plate will be in the down position (heat off) so that only engine compartment air is allowed to enter the air cleaner

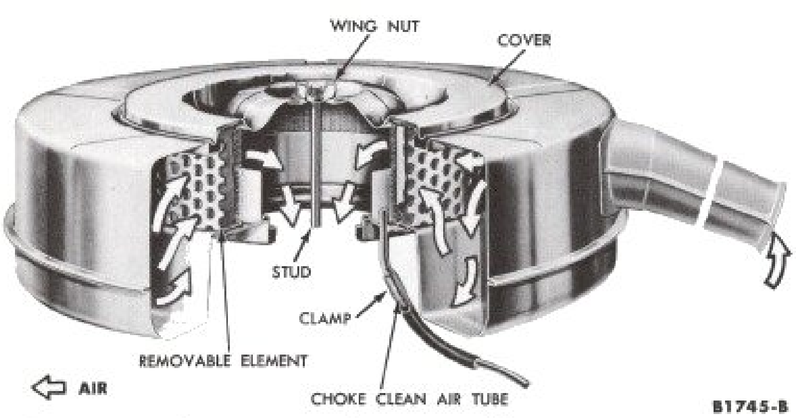


FIG. 1–Typical Dry Type Air Cleaner Assembly

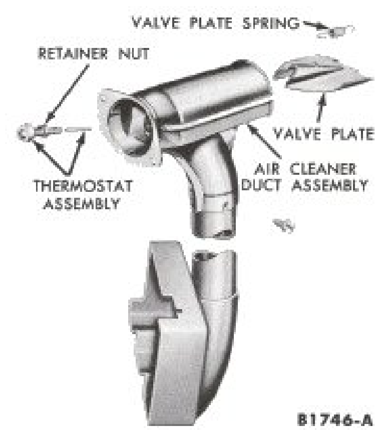


FIG. 2–Typical Air Inlet Duct–Disassembled

2 REMOVAL AND INSTALLATION

144, 170 AND 200 SIX

REMOVAL

1. Remove the bolt retaining the bracket to the air cleaner.

2. Remove the wing nut retaining the air cleaner assembly to the carburetor. Remove the air cleaner assembly, then remove the cover and lift the filter element out of the air cleaner body.

CLEANING

Refer to Part 10-1 for the recommended cleaning and inspection procedures.

INSTALLATION

1. Position the air cleaner body on the carburetor, and make certain the body is properly seated on the carburetor gasket.

2. Position the filter element in the body and install the cover.

3. Align the bracket with the retaining bolt hole. Tighten the carburetor air filter retaining wing nut. Install the bracket and tighten the retaining bolt.

260 AND 289 V-8

REMOVAL

1. To remove the entire air cleaner, remove the two wing-type screws that secure the air duct and thermostat assembly to the air cleaner. Remove the wing nut that secures the air cleaner to the carburetor. Remove the air cleaner assembly.

2. Remove the cover and lift the filter element out of the air cleaner body.

INSTALLATION

1. Position the air cleaner body on the carburetor. Connect the air duct to the air cleaner with two wing-type bolts. Tighten the bolts. Connect the choke clean air tube to the bottom of the air cleaner.

2. Place the element in the body. Install the cover and wing nut. Tighten the nut.

260 AND 289 V-8 AIR INTAKE DUCT

REMOVAL

1. Remove the air duct and shroud retaining nut and washer from the exhaust manifold.

2. Remove the two wing-type screws that secure the air duct and thermostat assembly to the air cleaner. Carefully lift the air duct, shroud and tube as an assembly from the engine.

DIAGNOSIS AND TESTING

Refer to Part 10-1 for the air duct testing procedures.

INSTALLATION

1. Install the thermostat and air duct assembly, and the shroud and tube assembly on the exhaust manifold as a unit.

2. Secure the thermostat and air duct assembly to the air cleaner with the two wing-type screws. Install the air duct to exhaust manifold retaining nut and washer.

DISASSEMBLY

1. Loosen the retaining screw and separate the shroud and tube assembly from the air cleaner duct and valve assembly (Fig. 2).

2. Check the operation of the thermostat and air duct assembly. Refer to "Tests and Adjustments" for the proper procedure. If inspection reveals that the valve plate is binding, or the thermostat is malfunctioning, remove the thermostat and valve plate as follows:

Detach the valve plate tension spring from the valve plate with the use of long-nose pliers. Loosen the thermostat lock nut and unscrew the thermostat from the mounting bracket. Remove the lock nut. Grasp the valve plate and withdraw it from the duct.

CLEANING

Refer to Part 10-1 for the recommended cleaning and inspection procedure.

ASSEMBLY

1. If it was necessary to disassemble the thermostat and air duct assembly, assemble the unit as follows:

Install the valve plate. Install the lock nut on the thermostat and screw the thermostat into the mounting bracket. Install the valve plate tension spring on the valve plate and the duct.

2. Check the operation of the thermostat and air duct assembly, then adjust the thermostat as required. Refer to "Tests and Adjustments" for the proper procedure.

3. Install the air cleaner duct and valve assembly on the shroud and tube assembly. Tighten the retaining screw.

PART 10-6 FUEL PUMP

1 DESCRIPTION AND OPERATION

DESCRIPTION

Single action fuel pumps are standard equipment for all car models.

The fuel pumps on the 6-cylinder engines are mounted on the lower, left-center of the engine cylinder block.

On all V-8 engines, the fuel pumps are mounted on the left-side of the cylinder front cover.

An AC design fuel pump (Fig. 1) with a long-life, disposable type fuel filter integrally mounted on the top side of the fuel pump body is used on the 6-cylinder engines.

A Carter design fuel pump (Fig. 2) with a long-life, disposable type integrally mounted fuel filter on the pump body is used on the 260 and 289 V-8 engines.

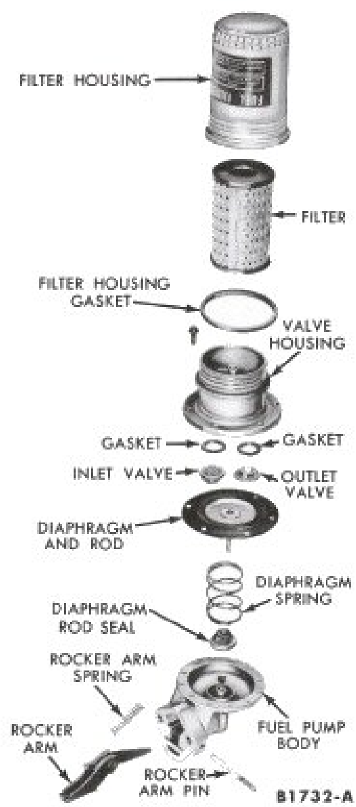


FIG. 1—AC Fuel Pump Assembly—Six-Cylinder Engine

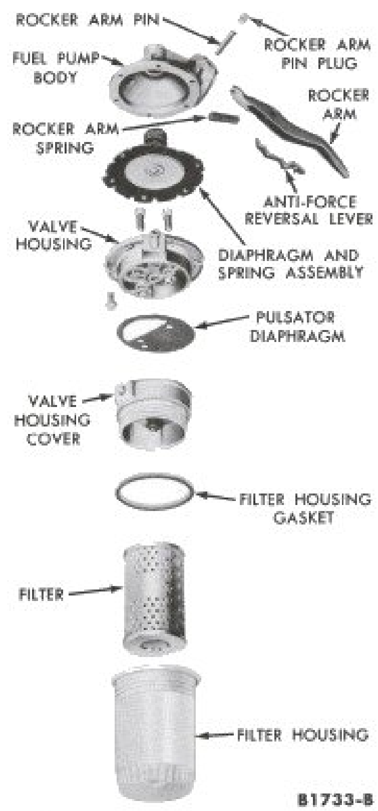


FIG. 2—Typical Carter Fuel Pump Assembly—V-8 Engine

OPERATION

The fuel pumps are mechanically actuated by means of the fuel pump rocker arm and an eccentric on the camshaft.

A flexible fuel pump diaphragm is operated by a combination of rocker arm action and calibrated spring tension.

On the fuel intake stroke, the camshaft eccentric causes the rocker arm to force the fuel pump diaphragm against the diaphragm spring pressure. This action draws fuel through the intake valve into the pump chamber and closes the outlet valve. At the same time, fuel is drawn from the fuel tank through the fuel intake line to replace the fuel drawn into the chamber.

As the camshaft eccentric continues to rotate, the rocker arm relieves the pressure on the diaphragm spring and allows the spring to move the diaphragm toward the inlet and outlet valves, against the pressure of the fuel built up in the fuel inlet chamber. This action causes the pump inlet valve to close and opens the outlet valve. The fuel is then forced through the pump outlet to the carburetor. **Fuel is delivered to the carburetor only when the fuel inlet valve in the carburetor is open. The carburetor inlet valve is closed by pressure of fuel on the float when the specified fuel level in the carburetor float chamber is reached.**

The fuel pump rocker arm serves only to lift the diaphragm against the diaphragm spring pressure during the fuel inlet stroke. When there is no demand for fuel from the carburetor, the diaphragm spring tension is not strong enough to force the diaphragm downward against the fuel pressure built up in the inlet chamber of the pump. Thus, the up and down rocker arm action continues, but the diaphragm remains stationary until pressure against the carburetor float is relieved by a demand for fuel at the carburetor.

The pulsator diaphragm in the fuel pumps (except AC 6-cylinder fuel pump) dampens the effect of fuel

pump pressure pulsations on the carburetor fuel inlet needle valve.

Pressure leak down bleed holes are incorporated in all fuel pumps.

An air vent is located in the fuel pump bodies to relieve air pressure build up on the spring side of the diaphragm.

The AC design fuel pumps contain a diaphragm rod seal to prevent the entrance of engine oil into the fuel pump.

2 REMOVAL AND INSTALLATION

REMOVAL

1. Disconnect the inlet and outlet lines at the fuel pump.
2. Remove the pump retaining screws, then remove the pump and the gasket. Discard the gasket.

INSTALLATION

1. Remove all the gasket material from the mounting pad and pump flange. Apply oil-resistant sealer to both sides of a new gasket.
2. Position the new gasket on the pump flange, and hold the pump in position against the mounting pad. Make sure the rocker arm is riding on the camshaft eccentric.
3. Press the pump tight against the pad, install the retaining screws, and alternately torque them to specifications.
4. Connect the fuel inlet and outlet lines.
5. Operate the engine and check for leaks.

3 MAJOR REPAIR OPERATIONS

6-CYLINDER ENGINES

AC FUEL PUMP

Disassembly

1. Remove the filter housing, gasket and filter element. Discard the filter element.
2. Scribe a line on the flanges of the pump body and valve housing to identify their original position.
3. Remove the valve housing from the fuel pump body.
4. Remove the staking marks from around the valves, remove both valves and their gaskets from the valve housing. **Carefully note the position of the valves in the valve housing cover so that new valves can be correctly installed.**
5. Using a blunt punch or tool T56L-9350-A, Detail 3, drive the

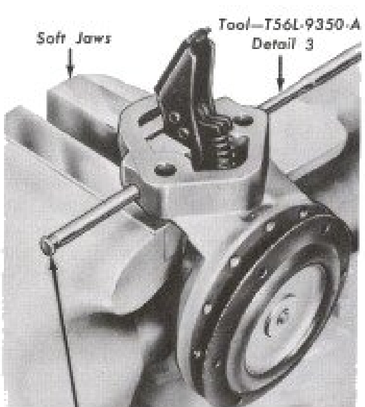


FIG. 3—Rocker Arm Pin Removal or Installation

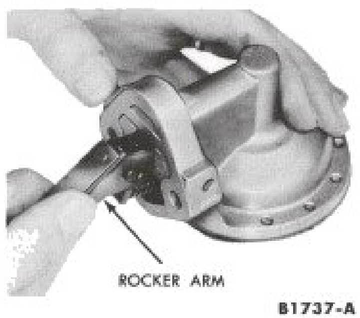


FIG. 4—Fuel Pump Diaphragm Removal

rocker arm pin out of the pump body (Fig. 3).

6. Press the pump diaphragm into the fuel pump body and pull the rocker arm outward to unhook the diaphragm actuating rod from the rocker arm and link assembly (Fig. 4).
7. Remove the diaphragm and diaphragm return spring, rocker arm and link assembly, and the rocker arm return spring from the pump body.
8. Remove the diaphragm actuating rod oil seal from the pump body (Fig. 1).

Cleaning and Inspection. Refer to Part 10-1 for the cleaning and inspection procedures.

Testing. Tests and diagnosis procedures are covered in Part 10-1.

Assembly

1. Install the diaphragm actuating rod oil seal and retainer so that the seal protrudes towards the diaphragm mounting flange (Fig. 1).
2. Seat the oil seal, using tool

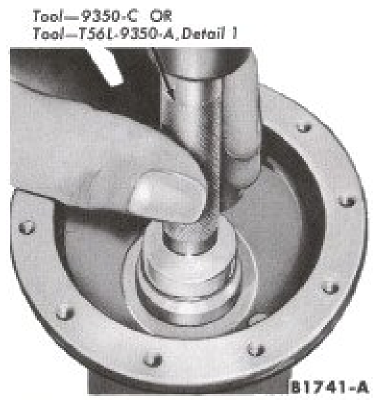


FIG. 5—Seating the Oil Seal

9350-C or T56L-9350-A, Detail 1 (Fig. 5).

3. Install the valves, and their gaskets, in the valve body so that the valve positions are as shown in Fig. 1.
4. Seat the valves firmly in the valve body, using tool 9350-D or T56L-9350-A, Detail 2. Stake the valves in place.
5. Lubricate the diaphragm actuating rod with grease.
6. Position the fuel pump diaphragm and spring assembly into the pump body as shown in Fig. 6.
7. Hold the diaphragm assembly in the pump body; position the pump body so that the mounting flange faces up. Apply slightly more pressure to the lower edge of the diaphragm, and insert the rocker arm link assembly with the cam shoe facing away from the diaphragm.

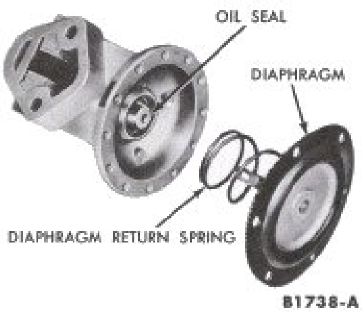


FIG. 6—Diaphragm Installation

Hook the rocker arm link to the diaphragm actuating rod.

8. Install the rocker arm return spring and hold it in place by cocking the rocker arm slightly.

9. Install the rocker arm pin in the pump body.

10. Position the valve body and pump body so that the previously scribed marks are aligned.

11. Install all the screws and the lockwashers until the screws just engage the fuel pump body. **Make sure that all of the screws pass through the holes in the diaphragm without tearing the fabric.**

12. Alternately and evenly tighten all of the screws.

13. Place a new filter element over the spout in the valve housing cover. Lightly lubricate and position the gasket, then screw the filter housing onto the pump. Hand tighten the filter housing until the gasket contacts the pump, then advance it 1/8 turn.

V-8 ENGINES

CARTER FUEL PUMPS

Disassembly

1. Remove the filter housing, gasket, and filter element. Discard the filter element.

2. Scribe marks on the fuel pump body, valve housing, and valve housing cover so that these parts can be assembled in their original position.

FIG. 7—Rocker Arm Seal Plug Removal

3. Remove the valve housing assembly. Separate the valve housing from the cover and note the position of the pulsator diaphragm so that it can be assembled in its proper position. **Do not remove the fuel valves from the valve housing. The valve housing is replaced as an assembly.**

4. Remove the rocker arm return spring.

5. Scrape away the staking mark and remove the rocker arm pin seal plug as shown in Fig. 7.

6. Press the fuel pump diaphragm into the fuel pump body to release the tension on the rocker arm and allow the rocker arm pin to fall out. If the pin does not come out freely, use needle nose pliers (Fig. 8).

7. Press the diaphragm into the fuel pump body and pull the rocker arm out to unhook the rod from the rocker arm link (Fig. 9).

8. Remove the fuel pump diaphragm assembly. Do not disassemble as the diaphragm and spring are serviced as an assembly.

Cleaning and Inspection. Refer to Part 10-1, Section 3, for the cleaning and inspection procedures.

Testing. Tests and diagnosis procedures are covered in Part 10-1, Section 2.

Assembly

1. Position the fuel pump diaphragm assembly into the pump body, then apply pressure on the diaphragm spring so that the rocker arm can be hooked on the rod as shown in Fig. 9.

2. Align the rocker arm pin holes by applying slight pressure on the diaphragm spring, then install the rocker arm pin (Fig. 8).

3. Install a new rocker arm pin seal plug. Stake the plug in position.

4. Position the rocker arm return spring on the boss in the pump body. Compress the spring and slip it over the tang in the rocker arm.

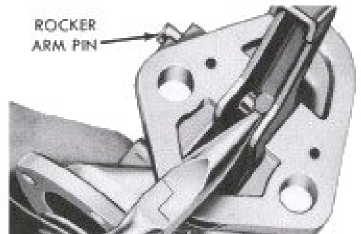


FIG. 8—Rocker Arm Pin Removal or Installation

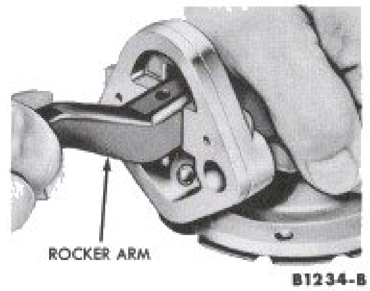


FIG. 9—Fuel Pump Diaphragm Removal or Installation

5. Place a new pulsator diaphragm on the valve housing in the position previously noted on disassembly (opening in the diaphragm over the fuel inlet chamber as shown in Fig. 10). Position the cover on the valve housing, aligning the scribed lines on the cover with the line on the valve housing. Be sure the pulsator diaphragm extends evenly around the edge of the cover. Install and tighten the two retaining screws and lock washers inside the valve housing.

6. Align the scribe line on the valve housing and the line on the fuel pump body. Hold the valve housing assembly tight against the fuel pump body and install the six screws and lockwashers. Be sure the fuel pump diaphragm extends evenly around the edge of the valve housing before tightening the retaining screws.

7. Place a new filter element over the spout in the valve housing cover. Lightly lubricate and position the gasket, then screw the filter housing on the pump. Hand tighten the filter housing until the gasket contacts the pump, then advance it 1/8 turn.

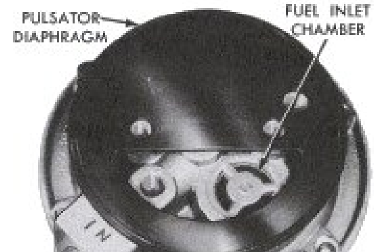


FIG. 10—Pulsator Diaphragm Installation

PART 10-7 FUEL TANK AND LINES

1 DESCRIPTION AND OPERATION

All vehicles with 6-cylinder engines (except Ranchero and Sedan Delivery) are equipped with a 14-gallon fuel tank (Figs. 1 and 2). Vehicles with 8-cylinder engines and all Rancheros and Sedan Delivery models are equipped with a 20-gallon fuel tank.

The tank of the passenger car is the center of the luggage compartment floor and is retained to the floor by screws. On station wagons, the tank is basically the same but is inverted. The station wagon tank is held by two steel support straps. Insulating pad strips are used between the support straps on the wagons and at contact points between the tank and floor pan or members on all vehicles.

The fuel sender unit is located on the front side of the tank and is accessible from underneath the car.

The fuel outlet line is fastened to a connecting hose that is attached to a line which enters the fuel tank through the sender unit assembly. A filter is located in the tank on the fuel line pick-up tube. **This filter does not require servicing.**

On cars, the fuel tank filler pipe opening is located in the center of the lower back panel.

On station wagons, the fuel tank filler pipe is located in the left, rear quarter panel, above and rearward of the wheel house opening.

The tank is vented through the fuel filler pipe cap on all Comet models and the Falcon station wagons and by a vent tube on the Falcon passenger cars. The filler pipe is attached to the tank with a hose and hose clamps. The fuel line is routed from the fuel tank, passing beneath the left side of the underbody; then, under the left fender and through the forward part of the fender apron. The complete fuel line is replaceable as a unit. However, only the damaged segments are usually replaced.

2 REMOVAL AND INSTALLATION

FILLER PIPE

The fuel filler pipe is removeable on all vehicles.

REMOVAL

1. Drain the fuel tank with a siphon to a level below the filler pipe connection in the tank.

2. Remove the retaining screws securing the filler pipe to the body panel. Loosen the hose clamp and loosen the hose from the filler pipe. Rotate the filler pipe and pull it outward to remove it from the fuel tank.

INSTALLATION

1. Position the filler pipe in the body panel and slide the hose onto the filler pipe. Install and tighten the filler pipe retaining screws.

2. Fill the fuel tank and install the filler cap. Check for fuel leaks.

FUEL TANK

The fuel tank installations are shown in Figs. 1 and 2.

CONVENTIONAL CAR

Removal

1. Raise the rear of the car and position safety stands

2. Remove the fuel tank drain plug and drain the fuel into a suitable container.

3. Disconnect the fuel gauge sending unit wire at the sending unit.

4. Loosen the hose clamp, slide the clamp forward and disconnect the fuel line at the fuel gauge sending unit.

5. Disconnect the fuel tank vent hose at the tank, if so equipped.

If the fuel gauge sending unit is to be removed, turn the unit retaining ring counterclockwise and remove the sending unit retaining ring and gasket.

6. Remove the spare tire from the luggage compartment. Pull the compartment floor mat out of the way for access to the fuel tank.

7. Remove the fuel tank filler neck retaining screws.

8. Loosen the filler neck to tank hose clamps. Remove the filler neck, mounting gasket, and filler neck to tank hose.

9. Remove the fuel tank to luggage compartment floor pan retaining screws and remove the fuel tank.

Installation

1. Make sure all the old sealer has been removed from the fuel tank mounting flange and mounting surface at the luggage compartment floor pan. Apply caulking cord to the fuel tank mounting surface at the luggage compartment floor pan.

2. Position the fuel tank to the luggage compartment floor pan and install the retaining screws.

3. Position the hose and filler neck assembly and gasket to the body back panel. Position the hose to the fuel tank neck.

4. Install the filler neck to body back panel retaining screws and tighten the hose clamps.

5. If the fuel gauge sending unit was removed, make sure all the old gasket material has been removed from the unit mounting surface on

the fuel tank. Using a new gasket, position the fuel gauge to the fuel tank and secure with the retaining ring.

6. Position the luggage compartment floor mat and install the spare tire.

7. Connect the fuel gauge sending unit wire to the sending unit.

8. Connect the fuel line at the fuel gauge sending unit and tighten the hose clamps securely. Install the drain plug.

9. Connect the fuel tank vent hose, if so equipped.

10. Remove the safety stands and lower the car.

11. Fill the tank and check all connections for leaks.

STATION WAGON, RANCHERO AND SEDAN DELIVERY

Removal

1. Siphon the fuel from the fuel tank into a suitable container.

2. Loosen the filler hose clamp at the tank and disconnect the hose.

3. Disconnect the fuel gauge sending unit wire at the sending unit.

4. Loosen the clamps and disconnect the flexible fuel line at the sending unit.

5. Remove the two nuts retaining the tank support straps to the underbody at the left side of the tank. Remove the straps and lower the tank.

6. Remove the fuel gauge sending unit.

Installation

1. Using a new gasket, install the fuel gauge sending unit.

2. Hold the tank in position against the underbody. Hook the support straps to the retainers in the underbody at the front of the tank. Position the straps over the studs, then install the nuts retaining the straps to the underbody at the rear of the tank.

3. Connect the fuel line and filler hose.

4. Connect the fuel gauge sending unit wire.

5. Fill the tank and check all connections for leaks.

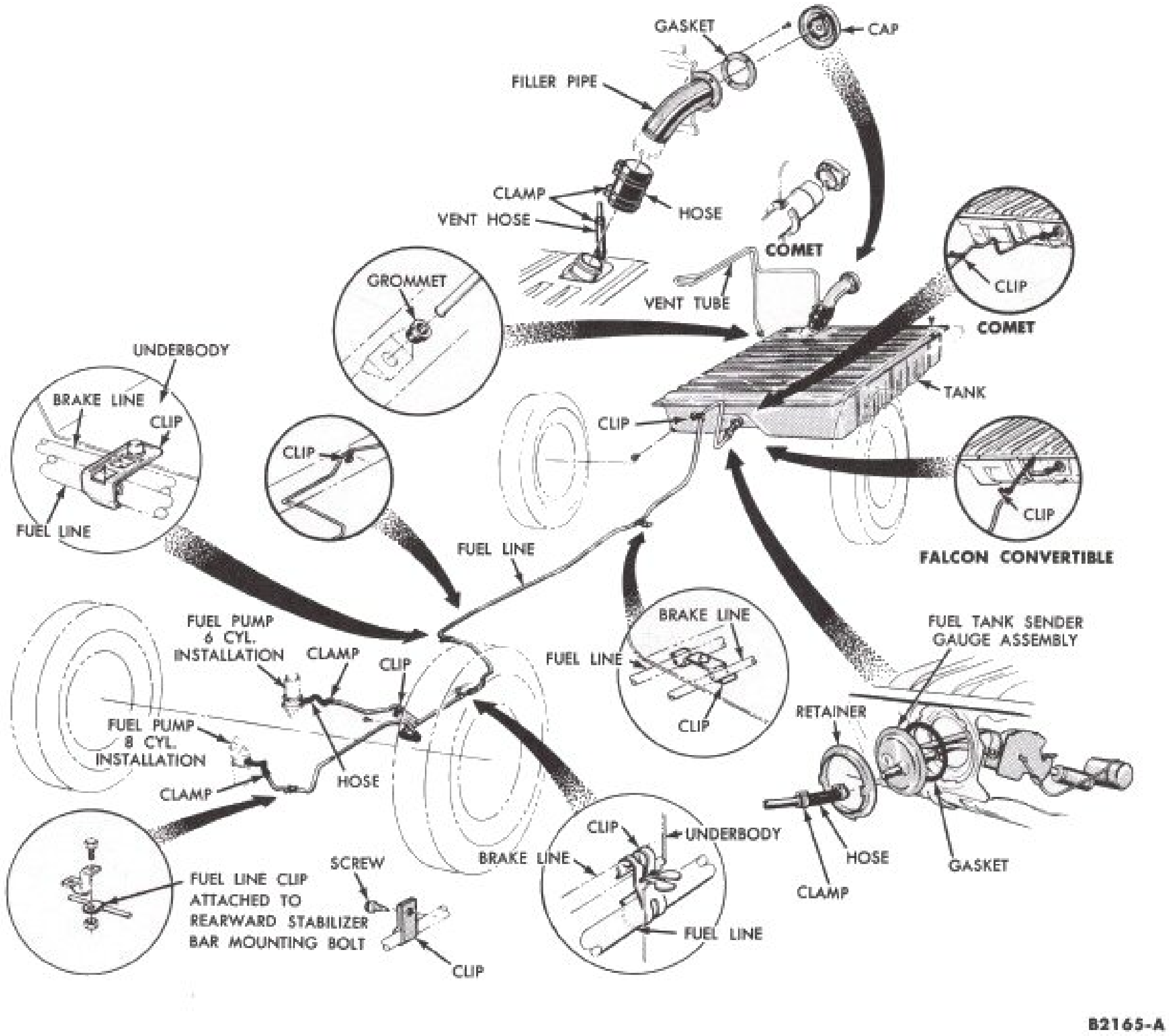


FIG. 1—Fuel System—Passenger Car

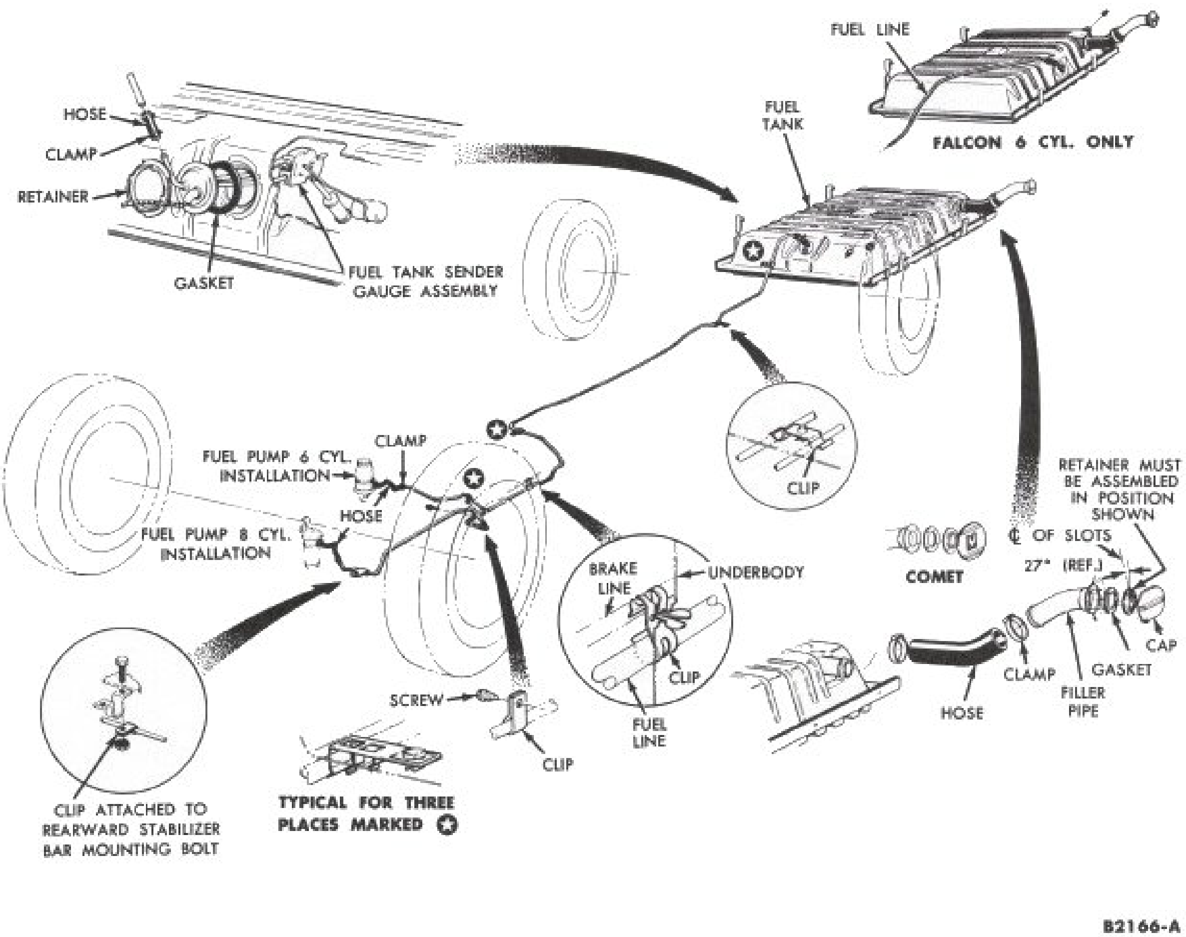


FIG. 2—Fuel System—Station Wagon

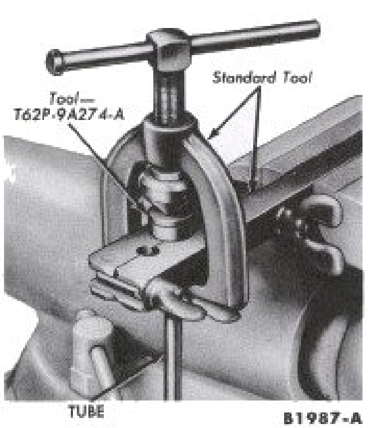


FIG. 3—Fuel Line Tube Die

FUEL LINES

The various fuel lines (Figs. 1 and 2) are not serviced as assemblies. They must be cut, squared and formed out of rolls of fuel system service tubing and hose material available at dealerships.

A damaged section of **tubing** longer than 12 inches can be cut out of the existing line and replaced by a comparable service **tubing section,** spliced into the line by means of connecting hoses and retaining clamps.

A damaged section of tubing shorter than 12 inches can be cut out of the line and replaced by a length of **service hose** and two retaining clamps. **All replacement hoses must be cut to a length that will insure proper clamp retention beyond the flared ends of the connecting tubing.**

REMOVAL

1. Drain the fuel from the tank.

2. Disconnect the line at the fuel gauge sender unit and the fuel pump. Remove the lines from the holding clips along the underbody. Remove all damaged hose sections and tube sections.

INSTALLATION

1. Cut a new section of tubing to approximately the same length as the section to be replaced. **Allow extra length for flaring the ends of the**

tubing. Square the ends of the cut tubing with a file.

2. Ream the inside edges of the cut tubing with the reamer blade on the tube cutter. **Be sure metal chips are removed from inside the tube(s).** Flare the ends of the cut tubing, as required, with a standard tube flaring kit and tool (Fig. 3).

3. Bend the tube section to conform to the contour of the original tube. Cut an ample length of hose to form a coupling between the flared ends of the fuel lines. Connect the hose couplings to the tubing and install the retaining clamps.

4. Position the lines in the underbody clips and tighten the clips. Connect the line to the fuel gauge sender unit and the fuel pump. Fill the tank and check for leaks.

PART 10-8 SPECIFICATIONS

FORD SINGLE-BARREL CARBURETORS

The basic part number of all the carburetors is 9510. The part number prefix and suffix appears on the identification tag mounted on the air horn.

CARBURETOR PART NO. C3DF-9510-R

Engine	144 Six (EET)
Transmission	Manual-Shift

CARBURETOR PART NO. C3DF-9510-S

Engine	144 Six (EET)
Transmission	Automatic

CARBURETOR PART NO. C3OF-9510-AK

Engine	Falcon 170 Six (EET)
Transmission	Manual-Shift

CARBURETOR PART NO. C3OF-9510-AL

Engine	Falcon 170 Six (EET)
Transmission	Automatic

CARBURETOR PART NO. C3YF-9510-F

Engine	Comet 170 Six (EET)
Transmission	Manual-Shift

CARBURETOR PART NO. C3YF-9510-G

Engine	Comet 170 Six (EET)
Transmission	Automatic

CARBURETOR PART NO. C3YF-9510-H

Engine	200 Six (EFZ)
Transmission	Automatic

THROTTLE BORE DIAMETER—Inches

All Carburetors	1$\frac{1}{16}$

VENTURI DIAMETER—Inches

C3DF-9510-R and S	1.015
C3OF-9510-AK and AL, C3YF-9510-F and G	1.100
C3YF-9510-H	1.200

MAIN METERING JET IDENTIFICATION NUMBER

0-5,000 Feet	
C3DF-9510-R	54F
C3DF-9510-S	53F
C3OF-9510-AK, C3YF-9510-F	60F
C3OF-9510-AL, C3YF-9510-G	59F
C3YF-9510-H	64F
5,000-10,000 Feet	
C3DF-9510-R	52F
C3DF-9510-S	51F
C3OF-9510-AK, C3YF-9510-F	58F
C3OF-9510-AL, C3YF-9510-G	57F
C3YF-9510-H	62F
10,000-15,000 Feet	
C3DF-9510-R	50F
C3DF-9510-S	49F
C3OF-9510-AK, C3YF-9510-F	56F
C3OF-9510-AL, C3YF-9510-G	55F
C3YF-9510-H	60F

SPARK CONTROL VALVE IDENTIFICATION COLOR

All Engines	Plain

SPARK CONTROL VALVE CLOSES @ INCHES OF MERCURY

All Engines	5.5-6.5

CHOKE PLATE PULLDOWN CLEARANCE—Inches

C3DF-9510-R and S, C3OF-9510-AK and AL	$\frac{3}{8}$
C3YF-9510-F, G and H	$\frac{1}{8}$

FORD SINGLE-BARREL CARBURETORS (Continued)

ACCELERATOR PUMP CLEARANCE

$\frac{3}{16}$ inch from pump cover surface to pin in "HI" position. (throttle plate seated in throttle bore).

FLOAT SETTING—DRY

1″ from bottom of float to surface of body (body inverted).

ANTI-STALL DASHPOT

C3DF-9510-S, C3OF-9510-AL, C3YF-9510-G and H	3¼-3¾ turns in

After initial contact of adjusting screw with diaphragm.

INITIAL IDLE MIXTURE ADJUSTMENT

All Carburetors	1-1½ Turns open*

*Turns back from bottomed needle.

CHOKE THERMOSTATIC SPRING HOUSING INITIAL SETTING

C3YF-9510-F, G and H	Set at index

CHOKE THERMOSTATIC SPRING IDENTIFICATION

C3YF-9510-F and G	TM
C3YF-9510-H	FM

DECHOKE CLEARANCE

¼ inch minimum between choke plate and air horn with throttle plate in the wide open position.

FAST (COLD) IDLE ADJUSTMENT

C3YF-9510-F	1300 rpm
C3YF-9510-G and H	1500 rpm

FORD DUAL CARBURETORS

The basic part number of all the carburetors is 9510. The part number prefix and suffix appears on the identification tag mounted on the air horn.

CARBURETOR PART NO. C4OF-9510-A

Engine	260 V-8 (EEY)
Transmission	Manual-Shift

CARBURETOR PART NO. C4OF-9510-B

Engine	260 V-8 (EEY)
Transmission	Automatic

CARBURETOR PART NO. C4DF-9510-E

Engine	Falcon Sprint 260 V-8 (EEY)
Transmission	Manual-Shift

CARBURETOR PART NO. C4DF-9510-F

Engine	Falcon Sprint 260 V-8 (EEY)
Transmission	Automatic

THROTTLE BORE DIAMETER—Inches

All Carburetors	1$\frac{1}{16}$

VENTURI DIAMETER—Inches

All Carburetors	1.010

BOOSTER VENTURI CODE LETTER

All Carburetors	H

FORD DUAL CARBURETORS (Continued)

MAIN METERING JET IDENTIFICATION NO.

0-5,000 Feet	
C4DF-9510-E, C4OF-9510-A	44F
C4DF-9510-F	43F
C4OF-9510-B	42F
5,000-10,000 Feet	
C4DF-9510-E, C4OF-9510-A	42F
C4DF-9510-F	41F
C4OF-9510-B	40F
10,000-15,000 Feet	
C4DF-9510-E, C4OF-9510-A	40F
C4DF-9510-F	39F
C4OF-9510-B	38F

POWER VALVE IDENTIFICATION NUMBER OR COLOR

C4DF-9510-E and F	Black (#55)
C4OF-9510-A and B	Black (#55)
0-5,000 Feet	Green (#75)
5,000-10,000 Feet	Yellow (#65)
10,000-15,000 Feet	Black (#55)

POWER VALVE TIMING—OPENS @ INCHES OF MERCURY

C4DG-9510-E and F	4.5-6.5
C4OF-9510-A and B	6.5-8.5

CHOKE PLATE PULL DOWN CLEARANCE—Inches

All Carburetors	7/64

ACCELERATOR PUMP SETTING

C4DF-9510-E, C4OF-9510-A
Link in the inboard hole of the pump lever and
#4 hole (40°F and below)
#3 hole (40° to 80°F)
#2 hole (80°F and above) in the overtravel lever.

C4DF-9510-F, C4OF-9510-B
Link in the inboard hole of the pump lever and
#4 hole (—15°F and below)
#3 hole (40°F to —15°F)
#2 hole (40°F to 80°F)
#1 hole (80°F and above) in the overtravel lever.

FLOAT SETTING—DRY

All Carburetors	1/2 ± 1/64 inch*

*From the machined surface of the main body to the top of the free end of the float with the float in the uppermost position.

INITIAL IDLE MIXTURE ADJUSTMENT

All Carburetors	1-1½ turns open*

*Turns back from bottomed needle.

ANTI-STALL DASHPOT CLEARANCE—Inches

C4DF-9510-F, C4OF-9510-B	1/16-3/32

FUEL LEVEL SETTING—WET*—Inches

All Carburetors	3/4 ± 1/32

*Below the top machined surface of the main body.

CHOKE THERMOSTATIC SPRING HOUSING INITIAL SETTING

Set at two digits in the rich direction.

CHOKE THERMOSTATIC SPRING IDENTIFICATION

C4DF-9510-E, C4OF-9510-A	TN
C4DF-9510-F, C4OF-9510-B	TO

DECHOKE CLEARANCE

1/16 inch minimum between choke plate and air horn with the throttle plates in the wide open position.

FAST IDLE CAM SETTING*—Inches

All Carburetors	3/32

*Clearance between choke plate and air horn, with the fast idle screw on the kickdown step of the fast idle cam.

FORD DUAL CARBURETORS (Continued)

FAST (COLD) IDLE ADJUSTMENT

C4DF-9510-E, C4OF-9510-A	1300 rpm
C4DF-9510-F, C4OF-9510-B	1600 rpm

FORD FOUR-BARREL CARBURETOR

The basic part number of the carburetor is 9510. The part number prefix and suffix appears on the identification tag mounted on the air horn.

CARBURETOR PART NO. C4GF-9510-D

Engine	Comet 289 V-8 (EGA)
Transmission	Manual-Shift

CARBURETOR PART NO. C4GF-9510-E

Engine	Comet 289 V-8 (EGA)
Transmission	Automatic

THROTTLE BORE DIAMETER—Inches

Primary and Secondary	1 9/16

VENTURI DIAMETER—Inches

Primary	1 1/8
Secondary	1 3/16

BOOSTER VENTURI CODE LETTER

Primary	
C4GF-9510-D	Y
C4GF-9510-E	Y
Secondary	B

MAIN METERING JET IDENTIFICATION NO.

Primary	
0-5,000 Feet	
C4GF-9510-D	50F
C4GF-9510-E	49F
5,000-10,000 Feet	
C4GF-9510-D	48F
C4GF-9510-E	47F
10,000-15,000 Feet	
C4GF-9510-D	46F
C4GF-9510-E	45F
Secondary	
0-5,000 Feet	55F
5,000-10,000 Feet	53F
10,000-15,000 Feet	51F

POWER VALVE IDENTIFICATION NO. OR COLOR

0-5,000 Feet	Plain (#85)
5,000-10,000 Feet	Green (#75)
10,000-15,000 Feet	Yellow (#65)

POWER VALVE TIMING—Opens @ Inches of Mercury

All Carburetors	7.5-9.5

CHOKE PLATE PULL DOWN CLEARANCE—Inches

C4GF-9510-D	5/32
C4GF-9510-E	9/64

ACCELERATOR PUMP SETTING

Link in the inboard hole of the pump lever and
#4 hole (40°F and below)
#3 hole (40°F to 80°F)
#2 hole (80°F and above) in the overtravel lever.

FLOAT SETTING—DRY*—Inches

Primary and Secondary	21/32 ± 1/64

*Measured from the machined surface of the main body to the top of the free end of the float, with the float in the uppermost position.

INITIAL IDLE MIXTURE ADJUSTMENT

C3OF-9510-AJ	1-1½ turns open*

*Turns back from bottomed needle.

FORD 4-BARREL CARBURETOR (Continued)

ANTI-STALL DASHPOT CLEARANCE—Inches	
C4GF-9510-E	$\frac{1}{16}$-$\frac{3}{32}$
FUEL LEVEL SETTING—WET*—Inches	
Primary and Secondary	$\frac{29}{32} \pm \frac{1}{32}$
*Distance below the top machined surface of the main body.	
CHOKE THERMOSTATIC SPRING HOUSING INITIAL SETTING	
C4GF-9510-D	Set one digit lean
C4GF-9510-E	Set three digits lean
CHOKE THERMOSTATIC SPRING IDENTIFICATION	TK
DECHOKE CLEARANCE	
$\frac{1}{16}$ inch minimum between choke plate and air horn with primary throttle plates in the wide open position.	
FAST IDLE CAM SETTING	
$\frac{1}{16}$ inch clearance between choke plate and air horn with the fast idle screw on the kickdown step of the cam.	
FAST (COLD) IDLE ADJUSTMENT	
C4GF-9510-D	1300 rpm
C4GF-9510-E	1500 rpm
(With fast idle screw on the kickdown stop of the fast idle cam) (hot engine).	

MECHANICAL FUEL PUMP

FUEL PUMP STATIC PRESSURE—Psi @ 500 Engine rpm	
All 6-Cyl.	3.5-5.5
All 8-Cyl.	4-6
MINIMUM FUEL PUMP VOLUME—Flow @ 500 Engine rpm	
All 6-Cyl.	1 pint in 30 seconds
All 8-Cyl.	1 pint in 20 seconds
ECCENTRIC TOTAL LIFT	
All 6-Cyl.	0.290-0.310
All 8-Cyl.	0.340-0.360

CARBURETOR AIR CLEANER

ALL ENGINES	Dry, Pleated Paper

FUEL TANK CAPACITY

6-CYLINDER (Except Ranchero and Sedan Delivery)	
U.S. Measure	14 gallons
Imperial Measure	$11\frac{1}{2}$ gallons
8-CYLINDER (and 6-Cylinder Ranchero and Sedan Delivery)	
U.S. Measure	20 gallons
Imperial Measure	$16\frac{1}{2}$ gallons

COOLING SYSTEM

GROUP 11

PART 11-1 GENERAL COOLING SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

DIAGNOSIS

Engine overheating and slow engine warm-up are the two engine troubles most commonly attributed to the cooling system.

Loss of coolant, thermostat stuck in the closed position, restricted air flow through the radiator, or the accumulation of rust and scale in the system are the main causes of overheating. Coolant loss may be due to external leakage at the radiator, radiator pressure cap, water pump, hose connections, heater, or core plugs. Coolant loss may also be caused by internal leakage due to a defective cylinder head gasket, improper tightening of the cylinder head bolts, or warped cylinder head or block gasket surfaces.

Internal leakage can be detected by operating the engine at fast idle and looking for the formation of bubbles in the radiator. Oil in the radiator may indicate leakage in the engine block or a leak in the automatic transmission oil cooler. Water formation on the oil level dipstick could also be an indication of internal leakage.

Rust and scale that form in the engine water passages are carried into the radiator passages by the circulation of the coolant. This clogs the radiator passages and causes overheating. Rust can be detected by the appearance of the coolant. If the coolant has a rusty or muddy appearance, rust is present.

A defective thermostat that remains open will cause slow engine warm-up.

DIAGNOSIS GUIDE

ENGINE OVERHEATS	Insufficient coolant. Belt tension incorrect. Radiator fins obstructed. Thermostat stuck closed.	Cooling system passages blocked by rust, scale or other foreign matter. Water pump inoperative. Faulty fan drive clutch.
ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	Thermostat stuck open or of incorrect heat range. Temperature sending unit defective (causing gauge to indicate low	engine temperature). Temperature gauge defective (not indicating true engine temperature).

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

LOSS OF COOLANT	Leaking radiator, radiator supply tank, or transmission oil cooler. Loose or damaged hose connections. Water pump leaking. Cylinder head gasket defective. Improper tightening of cylinder head bolts.	Cylinder block core plugs leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface. Radiator pressure cap defective or wrong type.

TESTING

COOLING SYSTEM PRESSURE TEST

It is recommended that a cooling system pressure test gauge be used to properly test the system for:

1. Blown or leaking cooling system sealing gaskets.

2. Internal or external coolant leakage.

3. Pressure cap malfunction.

Many types of pressure gauges are available for use. Therefore, it is recommended that the gauge manufacturer's instructions be followed when performing the test. **Never exceed the rated pressure indicated on the pressure cap when performing the pressure test.**

THERMOSTAT TEST

Remove the thermostat and immerse it in boiling water. Replace the thermostat if it does not open more than ¼ inch.

If the problem being investigated is insufficient heat, the thermostat should be checked for leakage. This may be done by holding the thermostat up to a lighted background. Light leakage around the thermostat valve (thermostat at room temperature) is unacceptable and the thermostat should be replaced. It is possible, on some thermostats, that a slight leakage of light at one or two locations on the perimeter of the valve may be detected. This should be considered normal.

FAN DRIVE CLUTCH TEST

1. Run the engine at approximately 1000 rpm until normal operating temperature is reached. This process can be speeded up by blocking off the front of the radiator with cardboard.

2. Stop the engine and, using a cloth to protect the hand, immediately check the effort required to turn the fan. If considerable effort is required, it can be assumed that the coupling is operating satisfactorily. If very little effort is required to turn the fan, it is an indication that the coupling is not operating properly, and it should be replaced.

2 MAINTENANCE

COOLANT

Correct coolant level is essential for maximum circulation and adequate cooling. In addition, for the cooling system to perform its function, it must receive proper care. This includes keeping the radiator fins clean and a periodic inspection of the cooling system for leakage.

Use care when removing the radiator cap to avoid injury from escaping steam or hot water.

In production, the cooling system is filled with a new long-life coolant. This coolant protects to −35°F. It will not be necessary to provide special anti-freeze protection except in areas where temperatures fall below this level. For year round protection from corrosion and overheating, and for low-temperature protection to −35° F, all coolant added should be a mixture of 50% Ford Rotunda coolant concentrate and water. **Use of greater than a 50-50 concentrate should be avoided to prevent possible overheating during warm weather. Do not mix permanent-type anti-freeze with the methanol type.**

In areas where protection to −35° F is not required, but some protection is necessary, refer to the coolant mixture chart on the Ford Rotunda coolant can for the recommended mixture proportions.

A standard ethylene glycol hydrometer can be used to check the protection level of the long-life coolant.

Refer to Group 19 for the recommended cooling system drain interval.

DRAINING AND FILLING THE COOLING SYSTEM

To drain the radiator, open the drain cock located at the right bottom of the radiator. The 6-cylinder engine block has one drain plug located at the right rear of the cylinder block, ahead of the starter (Fig. 1). The V-8 engines have a drain plug on each side of the cylinder block.

To fill the cooling system, close the drain cock. Install the block drain plug(s). Disconnect the heater outlet hose at the water pump to bleed or release trapped air in the system. When the coolant begins to escape, connect the heater outlet hose.

Operate the engine until normal operating temperature is reached, and add more coolant, if necessary, to fill the radiator to the proper level, one inch below bottom of filler neck.

After the initial fill the coolant level may drop approximately one quart after the engine has been operated about 20 minutes at 2000 rpm. This is due to the displacement of entrapped air.

FIG. 1—Typical Cylinder Block Drain Plug

FAN DRIVE BELTS

If the fan drive belt(s) are noisy, check the tension of the belts to make certain they are within specifications. Also, check for misaligned pulleys. If the drive belts are worn or frayed, replace them following the procedures in Section 3.

3 COMMON ADJUSTMENTS AND REPAIRS

ADJUSTMENTS

DRIVE BELTS

The fan drive belt(s) should be properly adjusted at all times. A loose drive belt(s) causes improper generator or alternator, fan and water pump operation. A belt(s) that is too tight places a severe strain on the water pump and the generator or alternator bearings.

Properly tensioned drive belts minimize noise and also prolong the service life of the belt. Therefore, it is recommended that a belt tension gauge be used to check and adjust the belt tension. **Any belt that has operated for a minimum of 10 minutes is considered a used belt, and when adjusted, it must be adjusted to the reset tension shown in the specifications.**

Belt Tension

1. Install the belt tension tool on the drive belt (Fig. 2) and check the tension following the instructions of the tool manufacturer.

2. If adjustment is necessary, loosen the generator or alternator mounting bolts and the generator or alternator adjusting arm bolt. Move the generator or alternator toward or away from the engine until the correct tension is obtained. Remove the gauge. Tighten the generator or alternator adjusting arm bolt and the mounting bolts. Install the tension gauge and check the belt tension.

REPAIRS

FAN REPLACEMENT

6-Cylinder Engines

1. Remove the capscrews and lock washers retaining the fan to the water pump hub. Remove the fan.

2. Position the fan on the water pump hub. Install the lock washers and capscrews and torque the capscrews to specifications.

V-8 Engines. On a car with an air conditioner or extra-cooling radiator, a fan drive clutch may be used (see specifications). Cars without air conditioning utilize a pulley-to-fan spacer.

1. Remove the radiator upper support and fan guard. Remove the capscrews and lock washers retaining the fan and spacer (or fan drive clutch) to the water pump hub. Remove the fan and spacer (or fan drive clutch).

2. If equipped with a fan drive clutch, remove the retaining capscrews and lock washers and separate the fan from the drive coupling. Position the replacement fan on the drive clutch and install the lock washers and capscrews.

3. Position the fan and spacer (or drive clutch) on the water pump hub and install the lock washers and capscrews. Torque the capscrews to specifications. Install the radiator upper support and fan guard.

FAN BELT REPLACEMENT

1. On a car with power steering, loosen the power steering pump bracket at the water pump and remove the drive belt.

On a car with an air conditioner, remove the compressor drive belt.

2. Loosen the alternator or generator mounting bolts and the alternator or generator adjusting arm bolt. Move the alternator or generator toward the engine. Remove the belt(s) from the alternator or generator and crankshaft pulleys, and lift them over the fan.

3. Place the belt(s) over the fan. Insert the belt(s) in the water pump pulley, crankshaft pulley and alternator or generator pulley grooves. Adjust the belt tension to specifications.

4. On a car with an air conditioner, install and adjust the compressor drive belt to specifications.

5. On a car with power steering, install the power steering pump drive belt and tighten the pump bracket to the water pump. Adjust the drive belt tension to specifications.

RADIATOR HOSE REPLACEMENT

Radiator hoses should be replaced whenever they become cracked, rotted or have a tendency to collapse.

1. Drain the radiator, then loosen the clamps at each end of the hose to be removed. Slide the hose off the radiator connection and the radiator supply tank connection (upper hose) or the water pump connection (lower hose).

2. Position the clamps on each end of the hose. Slide the hose on the connections. **Make sure the clamps are beyond the bead on the connections.** Tighten the clamps firmly. Fill the radiator with coolant. Operate the engine for several minutes, then check the hoses and connections for leaks. Check for proper coolant level after the engine has reached normal operating temperature.

Tool—T63L-8620-A

FIG. 2—Checking Drive Belt Tension

4 CLEANING AND INSPECTION

CLEANING COOLING SYSTEM

To remove rust, sludge and other foreign material from the cooling system, use either FoMoCo Regular Cooling System Cleanser or in severe cases use Heavy Duty Cleanser. Removal of such material restores cooling efficiency and avoids overheating.

In severe cases where cleaning solvents will not properly clean the

cooling system for efficient operation, it will be necessary to use the pressure flushing method.

Various types of flushing equipment are available. If pressure flushing is used, make sure the cylinder head bolts are properly tightened to prevent possible water leakage into the cylinders.

Always remove the thermostat prior to pressure flushing.

A pulsating or reversed direction of flushing water flow will loosen sediment more quickly than a steady flow in the normal direction of coolant flow.

RUST INHIBITOR

If water without anti-freeze is added to the cooling system after it has been cleaned, use FoMoCo Rust Inhibitor to prevent additional corrosion or rust. Rust inhibitor does not remove or dissolve rust. It is a preventive only and not a cleaner.

Rotunda anti-freeze contains anti-rust additive. Therefore, the addition of rust inhibitor is not necessary when anti-freeze is used in the cooling system.

WATER PUMP

1. Clean the gasket mounting surfaces of the water pump and cylinder block.

2. Clean and inspect the seal seating surface of the water pump.

3. Clean the pump housing and inspect it for cracks, sand holes, improper machining, and damaged surfaces. If the water pump housing is damaged beyond repair, replace the complete water pump.

FAN DRIVE CLUTCH

Check the control piston (Fig. 3) for free movement in the coupling. If the control piston sticks, remove the piston and clean it with emery cloth.

For fan drive clutch test procedures, refer to Part 11-1, Section 1.

Check the bi-metallic strip, and, if it is damaged, replace the complete fan drive clutch assembly. Bi-metallic strips are not interchangeable.

After the fan drive clutch is assembled, clean the drive with a clean cloth and solvent. **The fan drive clutch should not be dipped in any liquid.**

FIG. 3—Control Piston Installed

PART 11-2 WATER PUMP

1 DESCRIPTION AND OPERATION

On 6-cylinder engines, a centrifugal-type water pump is mounted on the front of the cylinder block. On the 260 and 289 V-8 the centrifugal-type water pump is mounted on the cylinder front cover. The water pump inlet port is connected to the radiator bottom tank to draw coolant from the radiator when the thermostat is open. On the V-8 engines a bypass port on the water pump is connected to the coolant outlet housing to permit coolant circulation within the engine when the thermostat is closed, bypassing the radiator. On the 6-cylinder engines, the water pump bypass passage is aligned with a bypass passage in the cylinder block for coolant circulation in the engine when the thermostat is closed.

A vane-type, cast-iron impeller supplies coolant through centrifugal action to the water pump outlet port on 6-cylinder engines. On the V-8 engines, the water pump has two outlet ports, one for each cylinder bank, to provide uniform coolant circulation in both banks of the engine.

The water pumps have a sealed bearing integral with the water pump shaft. The bearing requires no lubrication. A bleed hole in the water pump housing allows water that may leak past the seal to be thrown out by the slinger. **This is not a lubrication hole.**

The cooling fan hub is pressed a specified distance onto the water pump shaft.

2 REMOVAL AND INSTALLATION

144 SIX, 170 SIX AND 200 SIX

REMOVAL

1. Drain the cooling system.

On a car with power steering, remove the power steering drive belt.

On a car with air conditioning, remove the compressor drive belt.

2. Disconnect the radiator lower hose at the water pump. Remove the drive belt, fan, or fan and drive clutch, and water pump pulley.

3. Disconnect the heater hose at the water pump.

4. Remove the water pump.

INSTALLATION

1. If a new water pump is to be installed, remove the heater hose fitting from the old pump and install it on the new pump. Clean the gasket surfaces on the water pump and cylinder block.

2. Coat a new gasket on both sides with water-resistant sealer and position it on the cylinder block.

3. Position the water pump in place and install the lock washers and retaining bolts (the generator or alternator adjusting arm is retained by one water pump bolt). Torque the bolts to specifications.

4. Connect the radiator lower hose and the heater hose to the water pump.

5. Install the water pump pulley and fan or fan and drive clutch. Torque the bolts to specifications.

6. Install the drive belt and adjust the tension to specifications.

On a car with power steering, install the drive belt and adjust the tension to specifications.

On a car with air conditioning, install the compressor drive belt and adjust the tension to specifications.

7. Fill and bleed the cooling system. Operate the engine until normal operating temperature is reached. Check for leaks and check the coolant level.

260 V-8 AND 289 V-8

REMOVAL

1. Drain the cooling system.

On a car with power steering, remove the power steering drive belt.

On a car with an air conditioner, remove the compressor drive belt.

2. Disconnect the radiator lower hose and heater hose at the water pump. Remove the drive belt, fan, fan spacer or fan drive clutch and pulley.

3. Remove the bolts retaining the pump to the cylinder front cover. Remove the pump and gasket. Discard the gasket.

INSTALLATION

1. Remove all the gasket material from the mounting surfaces of the cylinder front cover and the water pump.

2. Position a new gasket, coated on both sides with water-resistant sealer, on the cylinder front cover; then, install the pump.

3. Install the retaining bolts and torque them to specifications.

On a car with power steering, install the power steering drive belt and adjust the tension to specifications.

On a car with an air conditioner, install the compressor drive belt and adjust the tension to specifications.

4. Install the pulley, spacer or fan drive clutch and fan. Install and adjust the drive belt to the specified belt tension. Connect the radiator hose and heater hose.

5. Fill and bleed the cooling system. Operate the engine until normal operating temperatures have been reached and check for leaks.

3 MAJOR REPAIR OPERATIONS

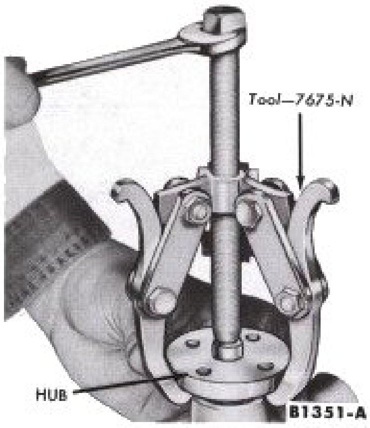


FIG. 4—Hub Removal —Falcon

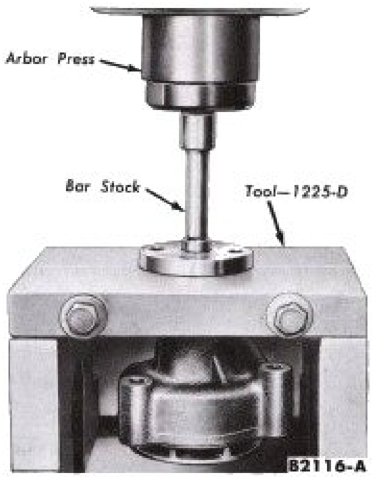


FIG. 5—Hub Removal —Comet

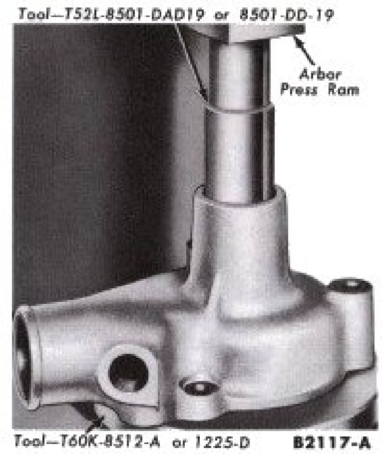


FIG. 6—Shaft and Bearing Removal

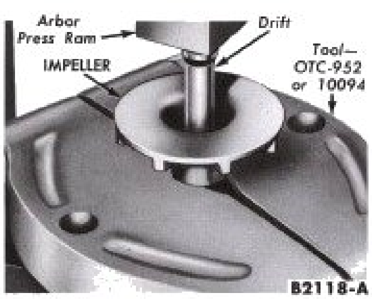


FIG. 7—Impeller Removal

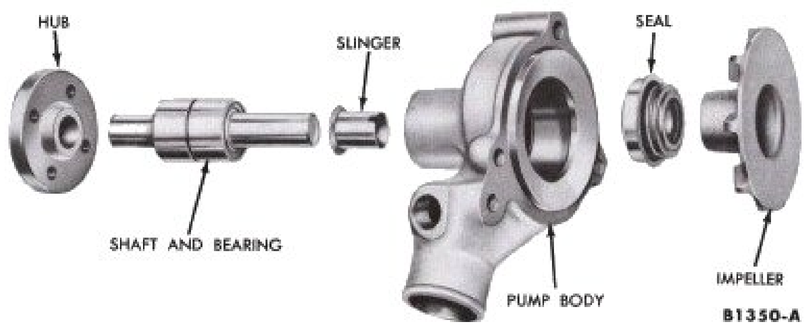


FIG. 8—Water Pump Assembly

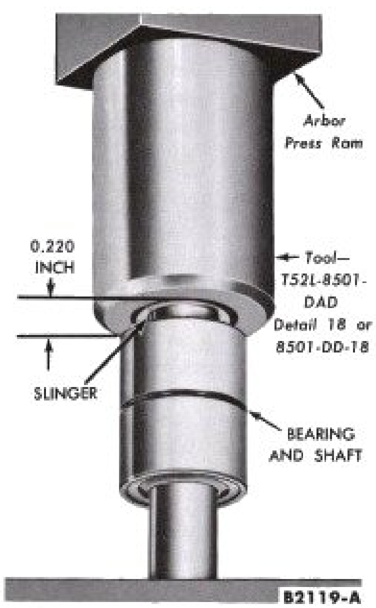


FIG. 9—Slinger Installation

144 SIX, 170 SIX AND 200 SIX

DISASSEMBLY

1. Remove the hub from the impeller shaft (Figs. 4 or 5).
2. Position the pump on an arbor press and press the shaft and bearing out of the housing (Fig. 6).
3. Remove the impeller from the shaft (Fig. 7).

ASSEMBLY

The water pump assembly is shown in Fig 8.

1. Clean all gasket material from the pump.
2. If a new shaft is used, install the slinger on the shaft in the same relative position as the slinger on the old shaft (Fig. 9).
3. Coat the bearing outer diameter with grease, and position the shaft and bearing assembly and press in into the housing (Fig. 10) until the outer end of the bearing is flush with the outer face of the pump housing.

FIG. 10—Shaft and Bearing Installation

On the Comet car, position the pump housing on tool 1225-D to

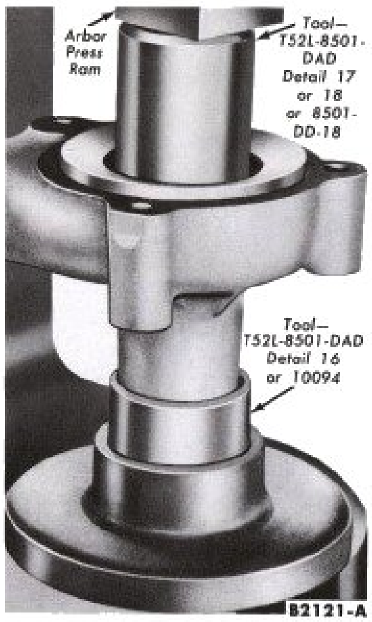


FIG. 11—Seal Installation

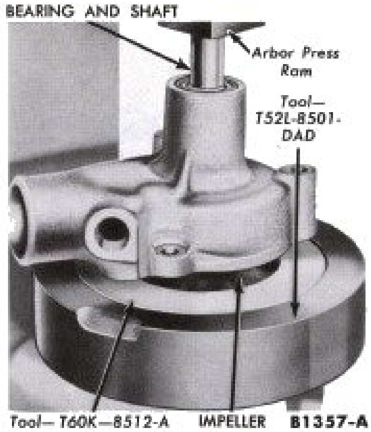


FIG. 12—Impeller Installation—Falcon

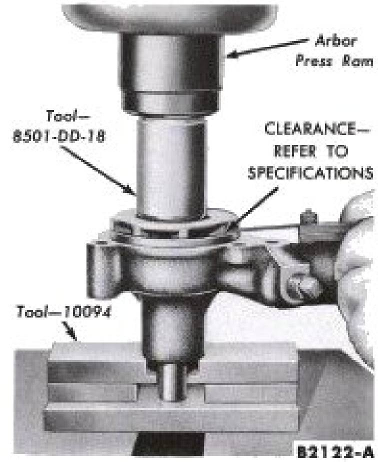


FIG. 13—Impeller Installation—Comet

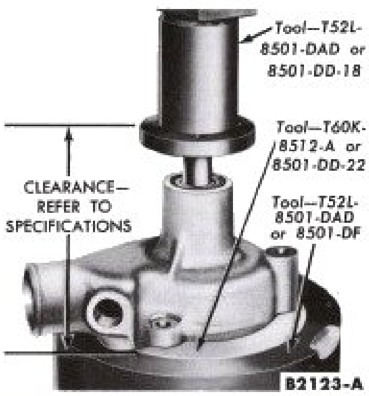


FIG. 14—Hub Installation

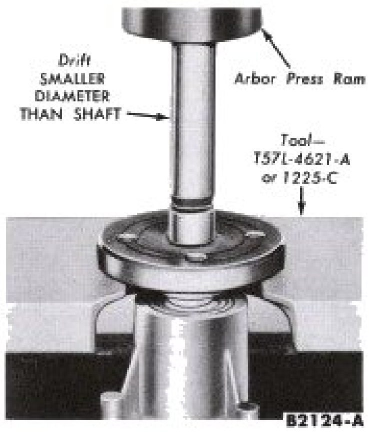


FIG. 15—Hub Removal

press the shaft and bearing assembly into the housing (Fig. 10).

4. Apply a light film of water-resistant sealer on a new seal and press the seal into the housing (Fig. 11).

5. Replace the impeller if it is damaged.

6. Lightly coat the seal rubbing face of the impeller with grease, then press the shaft into the impeller (Figs. 12 or 13). **Press the shaft into the impeller just far enough so that the pump housing lightly touches the face of the adapter ring. If excessive pressure is exerted on the shaft after the rear face of the housing contacts the adapter ring, the pump bearing will be damaged. The impeller to pump housing clearance is as shown in the specifications.**

7. Adjust the set screw in the bottom of the fixture plate until the screw touches the end of the shaft. Do not lift the pump body. Position the water pump hub over the shaft and press it into place, holding the specified distance from the housing mounting face to the hub front face (Fig. 14).

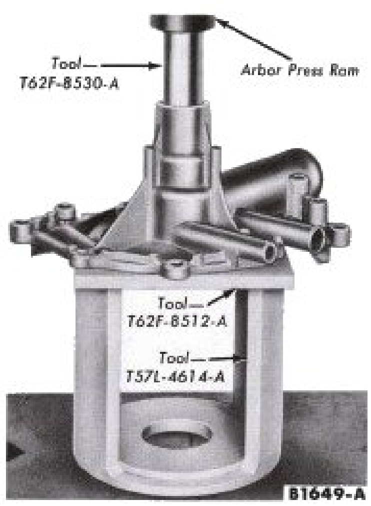


FIG. 16—Shaft, Seal and Impeller Removal—Falcon

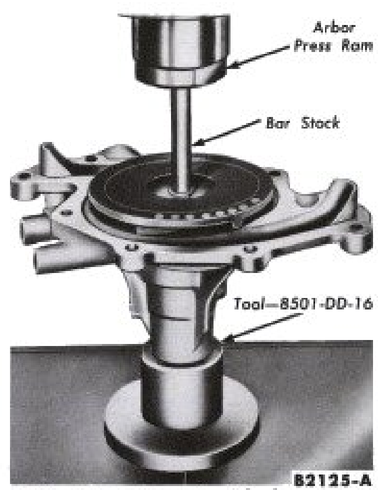


FIG. 17—Pressing Shaft Out of Impeller and Pump Housing—Comet

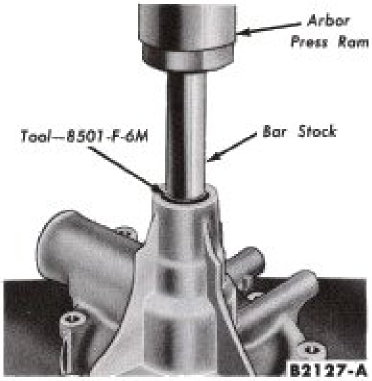


FIG. 18—Pressing Seal Out of Pump Housing—Comet

260 AND 289 V-8

DISASSEMBLY

1. Position the pump on an arbor press and press the hub off the shaft (Fig. 15).

2. On Falcon cars, press the shaft and impeller and seal out of the housing (Fig. 16). Press the shaft out of the impeller (Fig. 7).

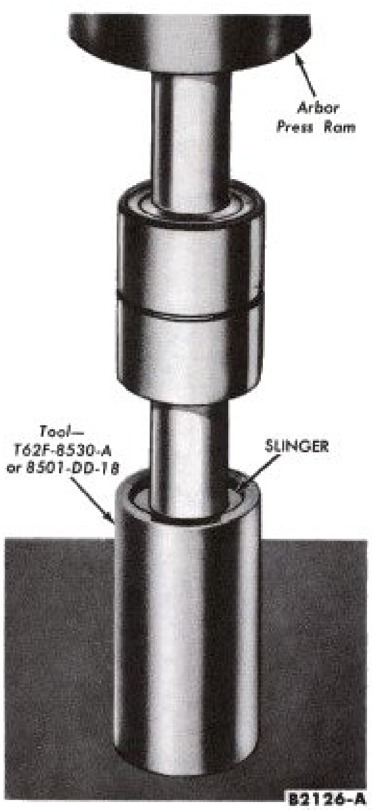


FIG. 20—Slinger Installation

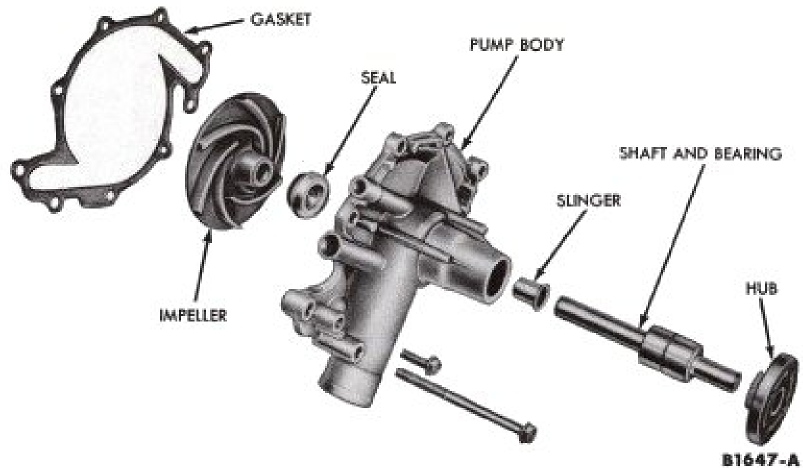


FIG. 19—Water Pump Assembly

3. On Comet cars, press the impeller shaft out of the impeller and out of the pump housing (Fig. 17). Remove the slinger from the shaft.

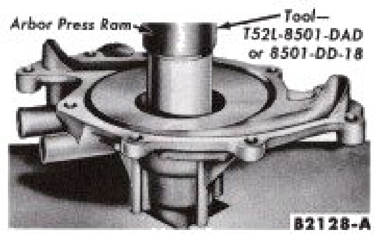


FIG. 21—Seal Installation

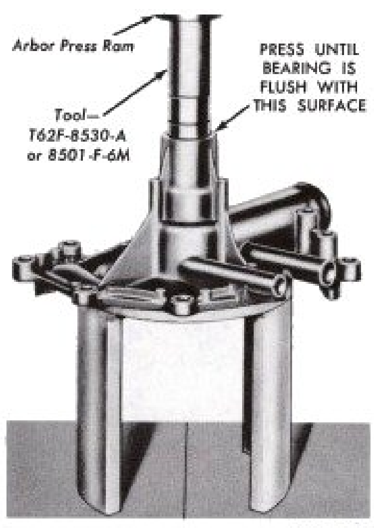


FIG. 22—Bearing and Shaft Installation

Press the seal out of the pump body (Fig. 18).

ASSEMBLY

The water pump assembly is shown in Fig. 19.

1. Install the new slinger on the new bearing and shaft assembly (Fig. 20). Press the slinger on until the tool bottoms. When using tool 8501-DD-18, the slinger should be pressed only until the distance from the flange to the end of the shaft is $1\frac{7}{8}$ inches.

2. Apply a light film of waterproof sealer on a new seal and press the seal into the housing (Fig. 21).

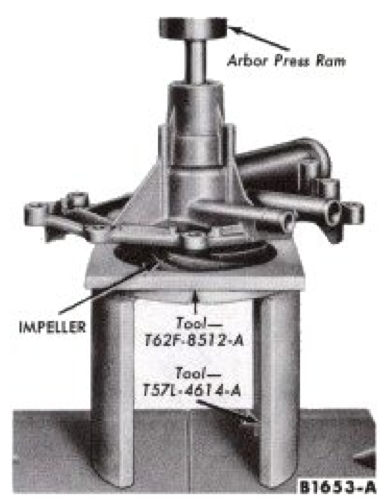


FIG. 23—Impeller Installation—Falcon

On Comet cars, position the housing on tool 8501-DD-16; then press the seal into the housing.

3. Coat the bearing outer diameter lightly with grease, and press the shaft and bearing into the pump housing (Fig. 22). Press the shaft and bearing into the housing until the bearing is flush with the face of the housing hub.

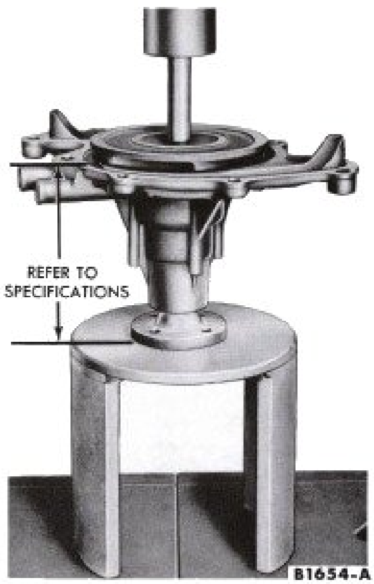


FIG. 24–Hub Installation–Falcon

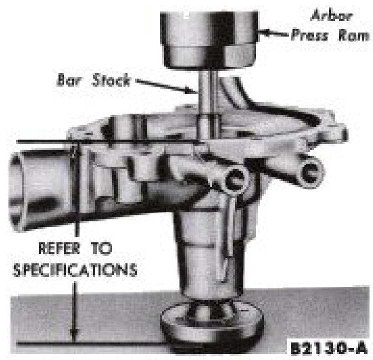


FIG. 25–Hub Installation–Comet

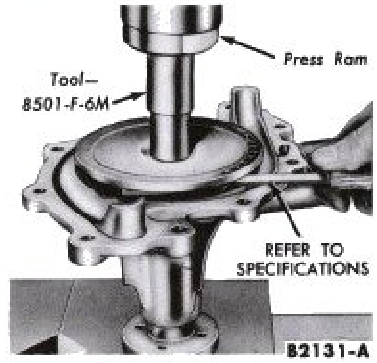


FIG. 26–Installing Impeller–Comet

4. On Falcon cars, replace the impeller if it is damaged. Coat the seal rubbing face of the impeller lightly with grease. Press the shaft into the impeller (Fig. 23).

Press the shaft into the impeller until the pump housing bottoms on the face of the adapter ring. If excessive pressure is exerted on the shaft after the rear face of the housing contacts the adapter ring, the pump bearing will be damaged. Impeller to pump housing clearance is shown in the specifications.

Position the shaft over the fan hub and press it into place, holding the specified distance from the housing mounting face to the front face of the hub (Fig. 24).

5. On Comet cars, press the shaft into the hub as shown in Fig. 25. Maintain the specified distance from the hub front face to the mounting face of the housing.

Replace the impeller if it is damaged. Coat the seal rubbing face of the impeller lightly with grease. Press the impeller onto the shaft (Fig. 26), maintaining the specified clearance between the impeller and housing.

PART 11-3 RADIATOR AND THERMOSTAT

1 DESCRIPTION AND OPERATION

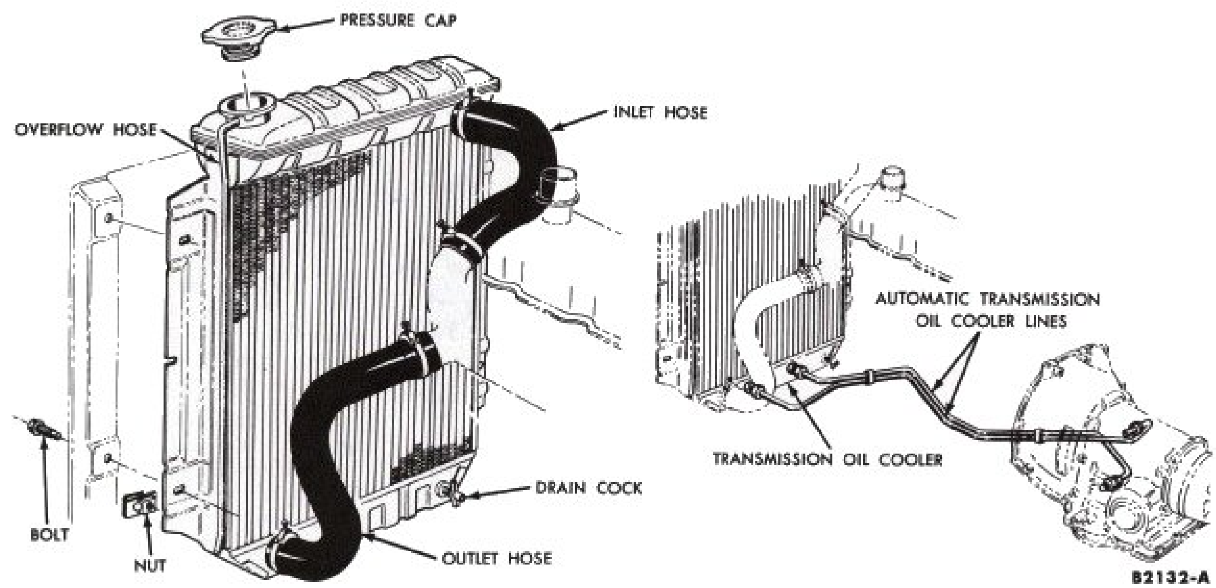


FIG. 27—6-Cylinder Radiator Installation

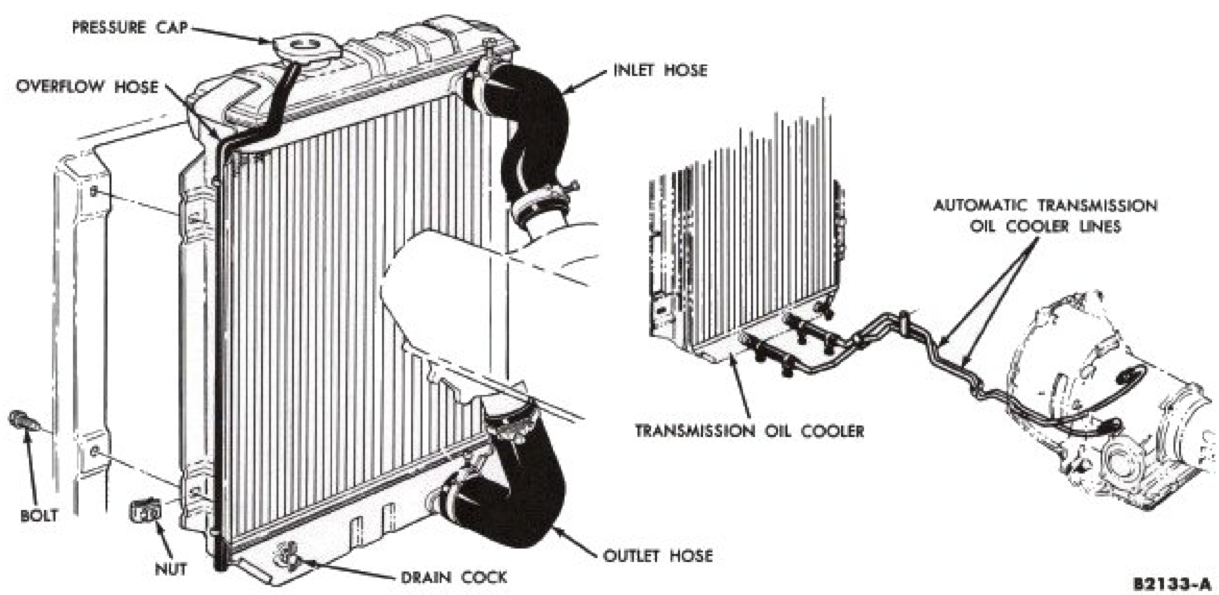


FIG. 28—V-8 Radiator Installation

RADIATOR

The radiators (Figs. 27 and 28) are of the tube and corrugated-fin-core type with the tubes arranged for vertical flow of the coolant. Two header tanks, one on the top and one on the bottom of the radiator provide uniform distribution of the coolant to the tubes. The radiator outlet port (lower header tank) is connected to the water pump inlet port. The radiator inlet port (upper header tank) is connected to the coolant outlet housing of the engine, thereby permitting coolant circulation through the radiator when the thermostat is open.

THERMOSTAT

A poppet-type thermostat is mounted in a recess in the coolant outlet passage at the front of the intake manifold on the V-8 engines. On 6-cylinder engines, the thermostat is located in the coolant outlet passage at the front of the cylinder head. When the thermostat is closed, coolant flows to the water pump through a bypass passage at the front of the engine. When the thermostat is open, coolant flows through the coolant outlet elbow (thermostat housing) to the radiator.

The thermostat used in production is for use with water or permanent-type anti-freeze. A thermostat is also available for use with non-permanent-type anti-freeze or water. For operating temperatures, refer to specifications.

Do not attempt to repair the thermostat. It should be replaced if it is not operating properly.

2 REMOVAL AND INSTALLATION

RADIATOR

The radiator installations are shown in Figs. 27 and 28.

REMOVAL

1. Drain the cooling system. Disconnect the radiator upper and lower hoses at the radiator.
2. On a car with automatic transmission, disconnect the oil cooler lines at the radiator.
3. Remove the radiator support bolts and remove the radiator.

INSTALLATION

1. If a new radiator is to be installed, remove the drain cock from the old radiator and install it in the new radiator. On a car with automatic transmission remove the oil cooler line fittings from the old radiator, and install them in the new radiator, using sealer M-46-11.
2. Position the radiator assembly and install the support bolts.
3. Connect the radiator upper and lower hoses.

On a car with automatic transmission, connect the oil cooler lines.

4. Close the drain cock. Fill and bleed the cooling system.
5. Operate the engine and check for leaks at the hose connections and the automatic transmission oil cooler lines. Check the automatic transmission fluid level.

THERMOSTAT REPLACEMENT

Check the thermostat before installing it, following the procedure under "Thermostat Test", Part 11-1.

Do not attempt to repair the thermostat. It should be replaced if it is not operating properly.

REMOVAL

1. Drain the cooling system to below the level of the coolant outlet housing.
2. Remove the coolant outlet housing retaining bolts and slide the housing with the hose attached to one side.
3. Remove the thermostat and gasket.

INSTALLATION

1. Clean the coolant outlet housing and cylinder head surface. Coat a new coolant outlet housing gasket with sealer. Position the gasket on the cylinder head or intake manifold (260 and 289 V-8). **The gasket must be positioned on the cylinder head or intake manifold before the thermostat is installed.**
2. Coat the edge of the thermostat with grease for thermostat adhesion. Position the thermostat in the recess of the coolant outlet housing so that the copper pellet or heat element will be in the cylinder head or intake manifold (260 and 289 V-8). Install the thermostat with the word "TOP" toward the top of the engine and the valve end of the thermostat facing outward. **If the thermostat is improperly positioned, it can cause a retarded flow of coolant.**
3. Position the coolant outlet housing and install the retaining screws. Torque the screws to specifications.
4. Fill the radiator. Operate the engine and check for coolant leaks and proper coolant level after the engine reaches normal operating temperature.

PART 11-4 FAN DRIVE CLUTCH

1 DESCRIPTION AND OPERATION

The fan drive clutch (Fig. 29) is a fluid coupling containing silicone oil. Fan speed is regulated by the torque-carrying capacity of the silicone oil. The more silicone oil in the coupling the greater the fan speed, and the less silicone oil the slower the fan speed.

A bi-metallic strip and control piston on the front of the fluid coupling regulates the amount of silicone oil entering the coupling. The bi-metallic strip bows outward with a decrease in surrounding temperature and allows a piston to move outward. The piston opens a valve regulating the flow of silicone oil into the coupling from a reserve chamber. The silicone oil is returned to the reserve chamber through a bleed hole when the valve is closed. Therefore, when the air passing through the radiator becomes hotter, the fan speed increases, and as the temperature increases, the fan slows down.

The input side of the coupling is attached to the water pump hub and the fan is attached to the output side. Fins are cast integrally on the exterior of the fluid coupling to dissipate the heat generated by the shearing action of the silicone oil.

2 REMOVAL AND INSTALLATION

REMOVAL

1. Remove the capscrews retaining the fan drive clutch to the water pump hub (Fig. 29). Remove the fan drive clutch and fan as an assembly.
2. Remove the retaining capscrews and separate the fan from the drive clutch.

INSTALLATION

1. Position the fan on the drive clutch and install the retaining capscrews.
2. Position the fan drive clutch and fan assembly to the water pump hub (Fig. 29). Install and tighten the retaining capscrews.

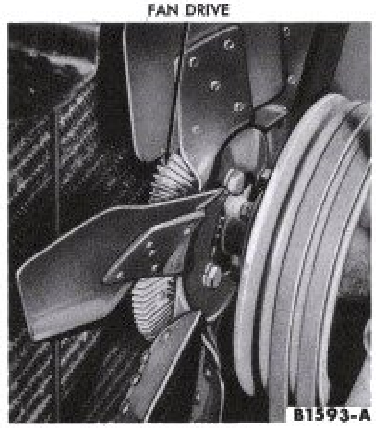


FIG. 29—Typical Fan Drive Clutch Installation

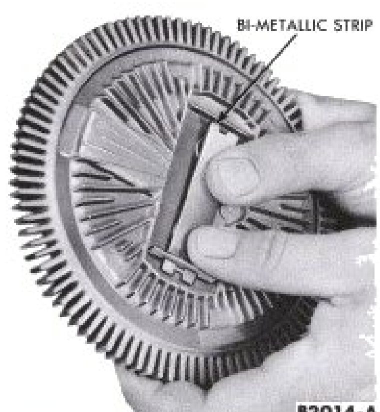


FIG. 30—Bi-Metallic Strip Removal or Installation

3 MAJOR REPAIR OPERATION

DISASSEMBLY

1. Remove the bi-metallic strip (Fig. 30) by pushing one end of the strip toward the fan clutch body so that it clears the retaining bracket. Then push the strip to the side so that the opposite end of the strip will spring out of the bracket.
2. Remove the control piston.

CLEANING AND INSPECTION

For cleaning and inspection procedures, refer to Part 11-1.

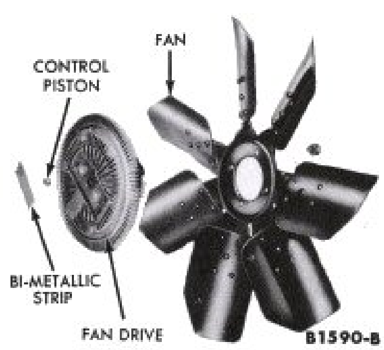


FIG. 31—Typical Fan and Drive Clutch

ASSEMBLY

The fan drive clutch is shown in Fig. 31.

1. Install the control piston (Fig. 3) so that the projection on the end of the piston will contact the bi-metallic strip.
2. Install the bi-metallic strip with the identification stamp "B-1" facing the fan drive clutch.

PART 11-5 SPECIFICATIONS

COOLING FAN

	OUTSIDE DIAMETER	NO. OF BLADES
Standard		
144	15.50	4
170	15.50	4
200	15.50	4
260	17.00	4
289	17.00	4
Extra Cooling		
170, 200, 260 and 289	17.00	5
Air Conditioning—Economy		
144 and 170	15.00	6
260 and 289	17.00	6
Air Conditioning		
260 and 289	17.00	6

WATER PUMP

WATER PUMP DRIVE ARRANGEMENT

Water pump, fan and generator or alternator drive belt from crankshaft damper.

WATER PUMP PULLEY TO ENGINE RATIO

Standard Cooling and Air Conditioner-Equipped	
144 and 170	1.04:1
200	1.18:1
260 and 289	1.05:1

WATER PUMP ASSEMBLY DIMENSIONS

Front Face of Pulley Hub to Pump Housing Face	
144, 170 and 200	3.94
260 and 289	5.150
Impeller to Housing Cover Mounting Surface Clearance	
144, 170 and 200	0.005-0.025
260 and 289	0.030-0.050

DRIVE BELT TENSION

BETWEEN GENERATOR OR ALTERNATOR AND WATER PUMP PULLEY (SINGLE BELTS)†

	NEW	USED
144, 170 and 200	90-120	60-90
260 and 289	110-140	80-110

BETWEEN GENERATOR OR ALTERNATOR AND WATER PUMP PULLEY (DUAL BELTS)†

FRONT	NEW	*USED
144, 170 and 200	90-120	60-90
260 and 289	110-140	80-110
REAR	**NEW**	***USED**
144, 170 and 200	85-135	55-110
260 and 289	105-155	75-120

*Belt operated for a minimum of 10 minutes is considered a used belt.
†Dual belts used when equipped with air conditioner.

COOLING SYSTEM CAPACITY

	Approximate Capacity* (quarts)	
	U.S. MEASURE	IMPERIAL MEASURE
STANDARD COOLING SYSTEM		
144 and 170	9½	8
200	16	13¼
260	14½	12
289	15	12½

*Add 1 quart extra for heater.

THERMOSTATS

LOW TEMPERATURE	
OPENS °F	
All Engines	155°-162°
FULLY OPEN	
All Engines	182°
HIGH TEMPERATURE	
OPENS °F	
All Engines	185°-192°
FULLY OPEN	
All Engines	210°-212°

TORQUE VALUES

NOTE: All specifications are given in Ft-Lbs. unless otherwise noted.

Water Pump to Cylinder Block (or Cylinder Front Cover)	
All Engines	12-15
Water Outlet Housing	
All Engines	12-15
Fan and Pulley to Pulley Hub	
All Engines	10-15
Fan to Fan Clutch (with a/c)	
170, 260 and 289	10-15
Radiator to Front End Sheet Metal	
All Engines	8-13
Radiator to Engine Hose Clamps	
All Engines	1.0-2.5
Transmission Oil Cooler Tubes to Oil Cooler Hose Clamps	
260 and 289 (V-8)	15-20 in-lbs
Radiator Inlet and Outlet Hose Clamps	
All Engines	1.0-2.5

EXHAUST SYSTEMS — GROUP 12

PART 12-1 EXHAUST SYSTEMS

1 DESCRIPTION

The exhaust systems for the various car models are shown in Figs. 1, 2, 3, 4, 5, and 6.

The exhaust system on cars with a six cylinder engine (Figs. 1, 2 and 3) consists of a muffler inlet pipe and a muffler with an integral outlet pipe.

The exhaust system on cars with a V-8 engine (Figs. 4, 5 and 6) consists of a Y-type muffler inlet pipe, a muffler inlet pipe extension and a muffler with an integral outlet pipe.

The location and type of exhaust system gaskets, retaining clamps and loop-type support brackets are shown in the respective exhaust system illustrations. The loop-type support bracket insulators eliminate tension on the hangers due to thermal expansion of the system.

2 IN-CAR ADJUSTMENTS AND REPAIRS

The exhaust system must be free of leaks, binds, grounding and excessive vibration.

Exhaust system vibration, grounding or binding is usually caused by loose, broken or improperly aligned clamps or brackets or improperly connected pipes. Any of the aforementioned conditions may cause changes to clearances of the exhaust system components. If any of these conditions exist, the exhaust system components must be checked, adjusted and neutralized (strain relieved) or replaced, to make certain the specified clearances (Figs. 1 thru 6) are maintained.

EXHAUST SYSTEM ALIGNMENT

Refer to Figs. 1 thru 6 and perform the following procedure to adjust and neutralize the exhaust system components:

1. Loosen the pipe connection clamps and the support bracket clamp(s).

2. Torque the exhaust manifold to inlet pipe retaining nuts evenly and alternately, to specifications. This is done to obtain an equal distance from the bottom of the inlet pipe flange(s) to the tips of the exhaust manifold(s).

3. Work from the front of the car toward the rear, and progressively adjust the exhaust system components and clamps at the various pipe connections to relieve binds, correct improper pipe connections or clearance conditions and torque the clamps to specifications.

4. Check the exhaust system for leaks.

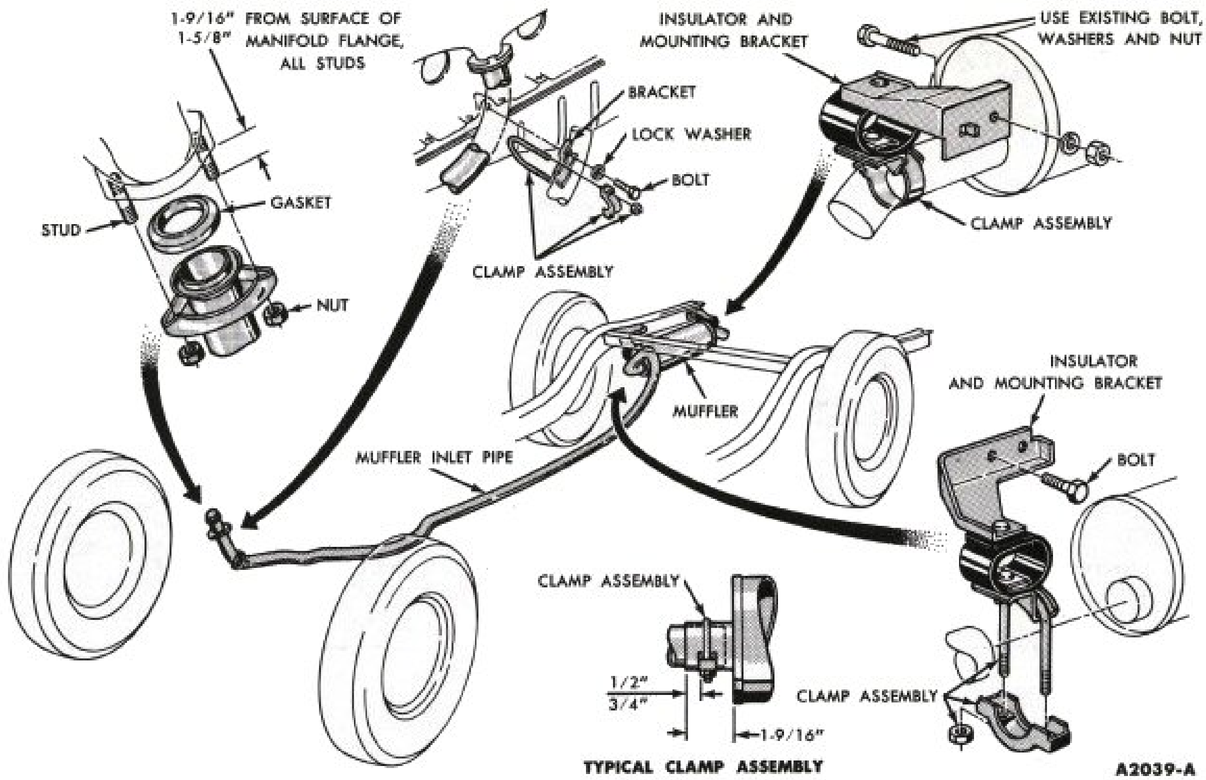


FIG. 1—Falcon 6-Cylinder Exhaust System—All Except Station Wagons

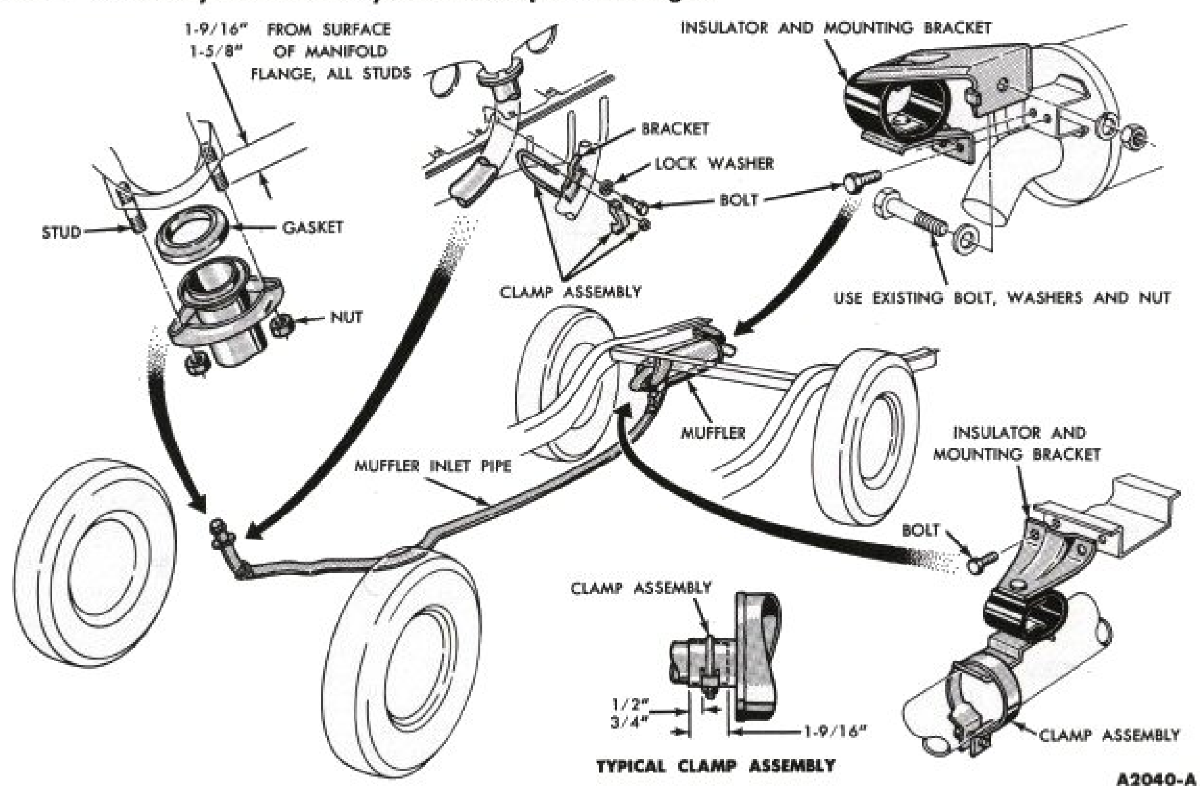


FIG. 2—Comet 6-Cylinder Exhaust System—All Except Station Wagons

3 REMOVAL AND INSTALLATION

MUFFLER AND OUTLET PIPE ASSEMBLY

REMOVAL

1. Loosen the inlet pipe or inlet pipe extension clamp at the muffler. Slide the clamp forward.

2. Remove the bolts or clamp that retain the muffler assembly to the rear support bracket.

3. Separate the muffler from the inlet pipe or inlet pipe extension and remove the muffler and outlet pipe assembly. Remove the clamp from the inlet pipe or inlet pipe extension.

4. Replace all worn or damaged parts.

INSTALLATION

1. Position the clamp on the inlet pipe or inlet pipe extension and slide the new muffler and outlet pipe assembly on the inlet pipe or inlet pipe extension.

2. Position the muffler and outlet pipe assembly to the rear support bracket. Install the muffler to support bracket retaining bolts or clamp and torque them to specifications.

3. Position the muffler to inlet pipe or inlet pipe extension retaining clamp the specified distance from the end of the pipe connection and torque the bolts to specifications. Start the engine and check the exhaust system for leaks.

INLET PIPE EXTENSION— V-8 ENGINES

REMOVAL

1. Remove the muffler and outlet pipe assembly by following steps 1 thru 3 under "Muffler and Outlet Pipe Assembly Removal".

2. On a Falcon Station Wagon or a Comet, remove the clamp from the bracket and insulator assembly.

3. Loosen the clamp at the inlet pipe and slide it away from the inlet pipe extension.

4. Remove the inlet pipe extension. Replace all worn or damaged parts.

INSTALLATION

1. Slide the inlet pipe extension onto the inlet pipe.

2. Position the inlet pipe to inlet pipe extension clamp on the connected pipes. Also position the clamp on the bracket and insulator assembly (if so equipped). Tighten the clamps snug, but not tight.

3. Install the muffler and outlet pipe assembly by following steps 1 and 2 under "Muffler and Outlet Pipe Assembly Installation".

4. Adjust and neutralize the exhaust system (refer to "Exhaust System Alignment" this Part, Section 2).

5. Start the engine and check the exhaust system for leaks.

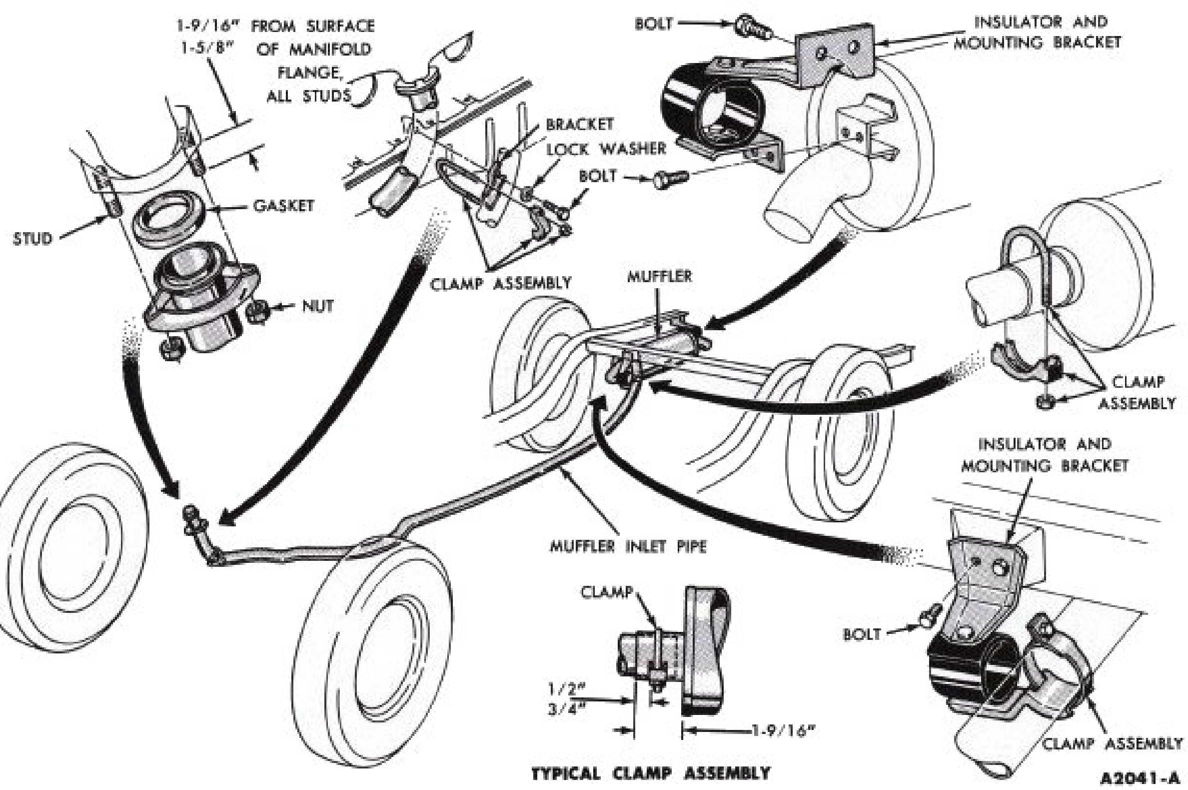


FIG. 3—Falcon and Comet 6-Cylinder Exhaust System—Station Wagons

INLET PIPE—6 CYLINDER ENGINES

REMOVAL

1. Remove the muffler and outlet pipe assembly by following steps 1 thru 3 under "Muffler and Outlet Pipe Assembly Removal".

2. Loosen the clamp(s) that secure the inlet pipe.

3. Remove the retaining nuts that secure the inlet pipe to the exhaust manifold.

4. Remove the inlet pipe.

5. Clean the gasket surfaces of the exhaust manifold and the inlet pipe.

6. Discard the gasket and replace any worn or damaged parts.

INSTALLATION

1. Install a new gasket on the inlet pipe flange.

2. Install the inlet pipe on the exhaust manifold and loosely install the retaining nuts on the studs of the manifold.

3. Place the retaining clamp(s) on the inlet pipe. Snug, but do not tighten the clamp(s).

4. Install the muffler and outlet pipe assembly by following steps 1 and 2 under "Muffler and Outlet Pipe Assembly Installation".

5. Adjust and neutralize the exhaust system, and properly position the retaining clamps. Torque the retaining clamps to specifications.

6. Start the engine and check the exhaust system for leaks.

INLET PIPE—V-8 ENGINES

REMOVAL

1. Loosen the inlet pipe clamp at the inlet pipe extension. Loosen the inlet pipe extension support bracket clamp.

2. Remove the muffler to support bracket retaining bolts or clamp. Temporarily support the inlet pipe and muffler in position with soft-wire.

3. Remove the retaining nuts securing the inlet pipe to the exhaust manifolds.

4. Slide the inlet pipe out of the inlet pipe extension and remove the inlet pipe from the exhaust manifolds.

5. Clean the gasket surfaces of the exhaust manifolds and inlet pipes.

6. Discard the gaskets and replace any worn or damaged parts.

INSTALLATION

1. Install new gaskets on the inlet pipe flanges.

2. Install the inlet pipe on the exhaust manifolds and loosely install the retaining nuts on the studs of the manifolds.

3. Connect the inlet pipe to the inlet pipe extension.

4. Position the muffler on the support bracket and install the retaining bolts or clamp. Then remove the soft wire used for a temporary support.

5. Adjust and tighten the exhaust system by following the instructions under "Exhaust System Alignment".

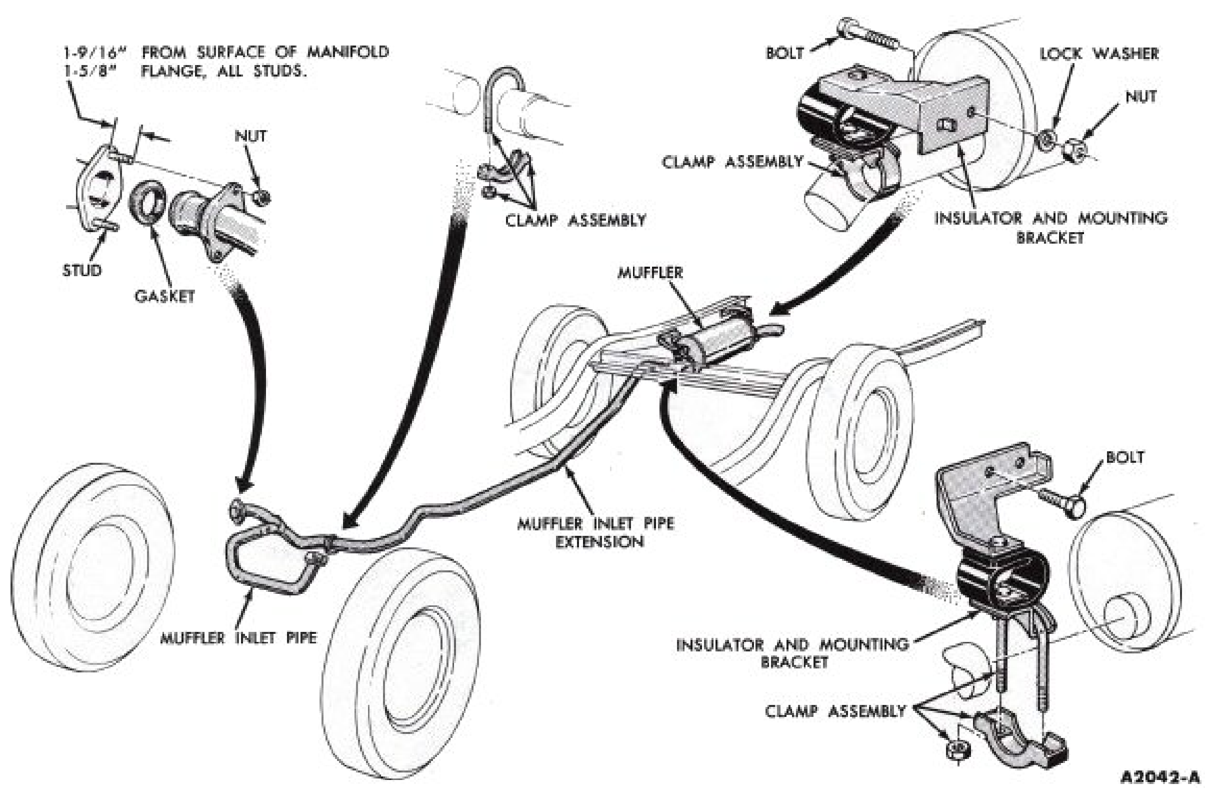


FIG. 4—Falcon V-8 Exhaust System—All Except Station Wagons

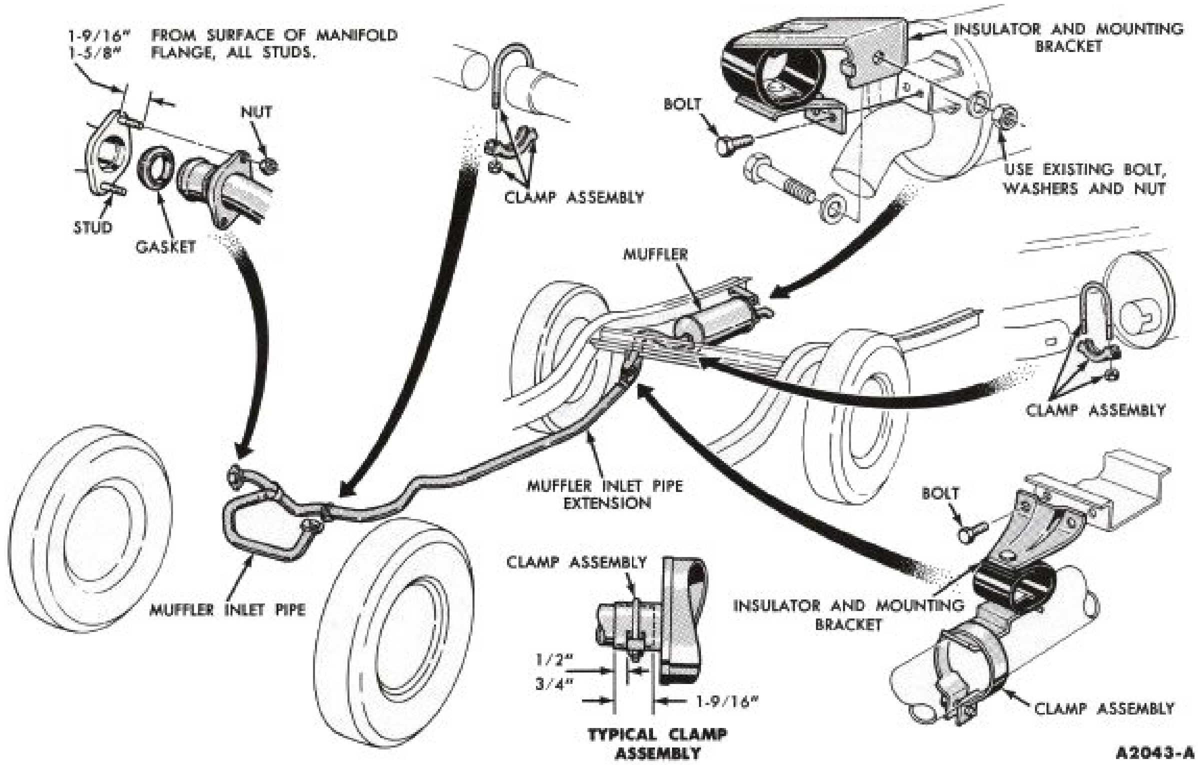


FIG. 5—Comet V-8 Exhaust System—All Except Station Wagons

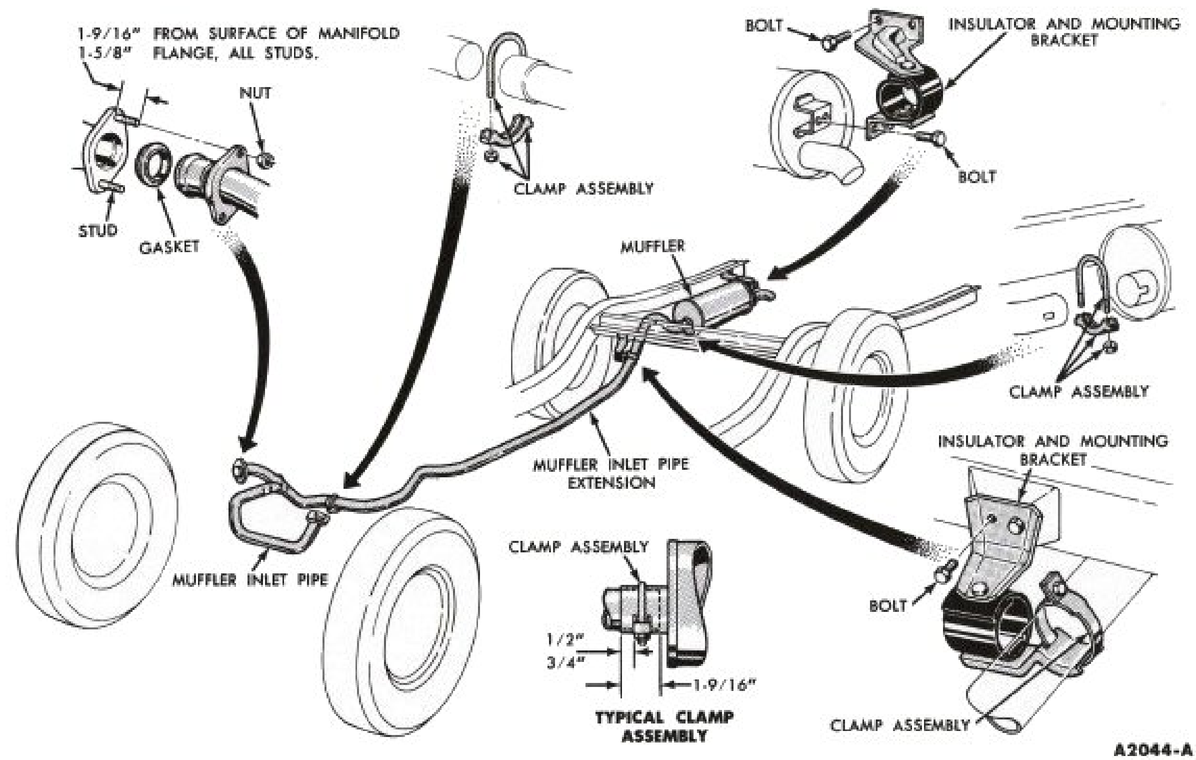


FIG. 6—Falcon and Comet V-8 Exhaust System—Station Wagons

PART 12-2 SPECIFICATIONS

TORQUE LIMITS—FT-LBS

Inlet Pipe to Exhaust Manifold(s)	25-35
Inlet Pipe to Inlet Pipe Extension Clamp	17-22
Inlet Pipe or Inlet Pipe Extension to Muffler Clamp	17-22
Muffler Support Bracket to Muffler Retaining Bolts	17-22
Muffler Support Bracket(s) to Muffler Clamp(s)	17-22
Inlet Pipe Extension Support Bracket Clamp	17-22
Inlet Pipe Bracket to Engine Bolt	17-22
Inlet Pipe Bracket Clamp	17-22
Outlet Pipe to Muffler Clamp	17-22

CHARGING SYSTEM — GROUP 13

PART 13-1 GENERAL CHARGING SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

GENERATING SYSTEM TROUBLE DIAGNOSIS GUIDE

BATTERY LOW IN CHARGE

Indications of a battery low in charge are slow cranking, hard starting, and headlights dim at engine idle speed. Causes are:

1. The generator belt worn, or loose and slipping over the pulley.
2. The battery in such poor condition that it will not hold or take a charge.
3. The generator not producing its rated output.
4. Regulator units out of adjustment, and excessive resistance in the generator-to-battery circuit or in the battery-to-ground circuit.

First check the belt adjustment and condition.

RECHARGE OR REPLACE BATTERY

Perform a battery Before Charge Test (Section 1 in this part). Replace the battery if the test indicates it is worn out or under capacity. If the battery capacity is normal, proceed as follows:

TEST GENERATOR OUTPUT

Test the generator output (Section 1 in this part) to determine if the generator is at fault. If the output is normal or greater than the rating of the unit, proceed with the regulator test if the unit is a generator. If the unit is an alternator, first check the external circuit to determine the circuit resistance (page 13-4). If the output is low proceed as follows:

OUTPUT LOW

Connect a heavy jumper wire from the battery ground post to the generator ground terminal. Repeat the output test. If the output now reaches or exceeds rated output, either the generator or the battery is not properly grounded to the engine frame. Replace the battery-to-ground cable if it is corroded or partially broken. Clean the cable connections at the battery and engine, and tighten the connections. Tighten the generator mounting bracket bolts.

If the output is still less than normal, the output could be low due to an open or short circuit in the field, armature, brushes, or brush holders, or the generator brushes can be worn too short or may be sticking in the brush holder and not making good contact on the commutator. Remove the unit for repair.

TEST REGULATOR

If the generator output is normal, test the regulator to determine if it is properly adjusted.

After checking all regulator units, adjust or replace the regulator as necessary. If the regulator is not at fault, test the circuit resistance.

TEST CIRCUIT RESISTANCE

Check the external circuit to determine the circuit resistance (page 13-4).

RESISTANCE EXCESSIVE

If the resistance (voltage drop) is greater than that specified for the car, locate the trouble by performing a complete external circuit resistance test (page 13-4). Repair or replace the defective part.

RESISTANCE NORMAL

If the resistance (voltage drop) is equal to or less than that specified for the car, the battery is low in charge due to improper operation such as:

1. Excessive use of accessories.
2. Short trips.
3. Accidental discharge of battery.
4. Incorrect engine lubricant for ambient temperature encountered.
5. Regulator calibration set too close to low limit for vehicle operating conditions.

HIGH CHARGING RATE

Indications of a high charging rate are:

1. Generator, lights, or fuses burn out repeatedly.

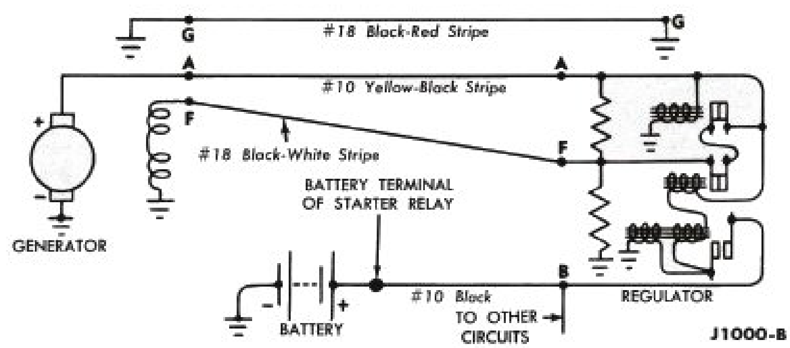


FIG. 1—Generator System Schematic

2. Battery requires too frequent refilling.

3. The ignition contacts have a short life.

To determine the possible cause of the high charging rate, check the following items.

1. Make certain that all connections, including the regulator ground, are tight.

2. Check the voltage limiter. If the voltage limit is high, check the contacts and replace the regulator if the contacts are burned.

3. If the contacts are in good condition, adjust the regulator to the specified limits (see Specifications in this Group).

In cases where a generator itself burns out, in addition to the high voltage, a high setting of the current limiter could account for the failure.

TESTING

To obtain the most accurate charging system test readings, the ammeters and voltmeters should register the expected readings in the middle range of the meter scale. Fig. 1 shows the generator system schematic.

GENERATOR TESTS

GENERATOR OUTPUT TEST

When a generator output test is conducted off the car, a generator-regulator test bench must be used. In this case, the generator is placed on the test bench and driven by a motor. Follow the procedure given by the manufacturer.

To test the output of the generator on the car, proceed as follows:

Disconnect the regulator armature and field wires at the generator. Connect a jumper wire from the generator armature terminal to the generator field terminal and the positive lead of a 0-100 ammeter to the generator armature terminal (Fig. 2). Start the engine and while it is idling, connect the ammeter negative lead to the positive terminal of the battery.

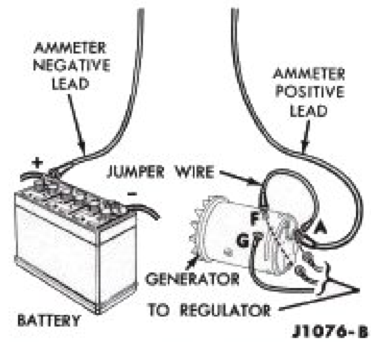


FIG. 2—Generator Output Test

Run the engine at 1500 rpm, and read the current output on the ammeter. The generator should reach or exceed its rated output. **Disconnect the test leads as soon as the test is completed to prevent overheating the generator, and then stop the engine.**

ARMATURE TESTS

Checking the armature for open, short, or grounded circuits must be done off the car.

OPEN CIRCUIT TEST. An open circuit in the armature can sometimes be detected by examining the commutator for evidence of bad burning. A badly burned spot on the commutator is caused by an arc formed every time the commutator segment connected to the open circuit passes under a brush.

FIG. 3—Growler Test For Shorted Armature

SHORT CIRCUIT TEST. To test the armature for a short circuit in the windings, a "growler" must be used as shown in Fig. 3. Rotate the armature slowly. When the shorted winding is under the steel strip, it will cause the strip to vibrate.

GROUNDED CIRCUIT TEST. To determine if the armature windings are grounded, make the connections as shown in Fig. 4. If the voltmeter indicates any voltage, the armature windings are grounded to the frame.

FIELD TESTS

Only two tests are necessary for checking the field. Both open and short circuits can be tested in one operation. The second test is for a grounded circuit.

OPEN OR SHORT CIRCUIT TEST. Disconnect the field lead from the generator terminal. Connect a 0-5 ammeter from the battery to the field terminal as shown in Fig. 5. The normal current draw, as indi-

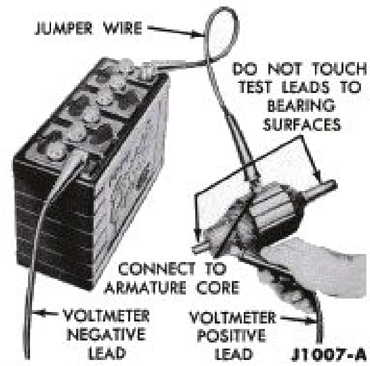


FIG. 4—Armature Grounded Circuit Test

cated by the ammeter, should be 1.5 to 1.6 amperes. If there is little or no current flow, the field has a high resistance or is open. A current flow, considerably higher than that specified above, indicates shorted or grounded turns.

GROUNDED CIRCUIT TEST. Remove the ground terminal stud from the generator frame. Make the voltmeter and battery connections as shown in Fig. 6. If the voltmeter indicates any voltage, the field coils are grounded. **Be sure that the ground terminal stud is not touching the housing.**

GENERATOR REGULATOR AND CIRCUIT TESTS

The four tests presented here are outlined for on-the-car operation and should be conducted in the sequence indicated. Be sure that the regulator

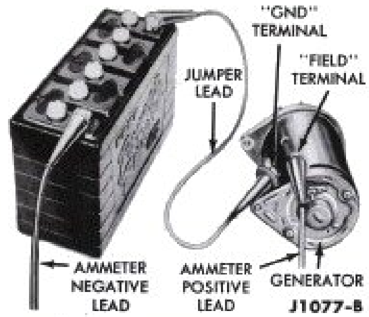


FIG. 5—Field Open Circuit Test

is at "normal" operating temperature (equivalent to the temperature after 20 minutes of operation on the car with the hood down). Connect the test equipment as shown in Figs. 7 or 8.

Always be careful when making any test connections to the regulator, so as not to short the battery lead or terminal to the regulator field terminal. To do so will burn the regulator contacts. Disconnect a battery cable while making these connections.

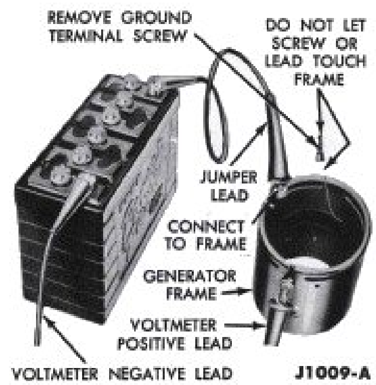


FIG. 6—Field Grounded Circuit Test

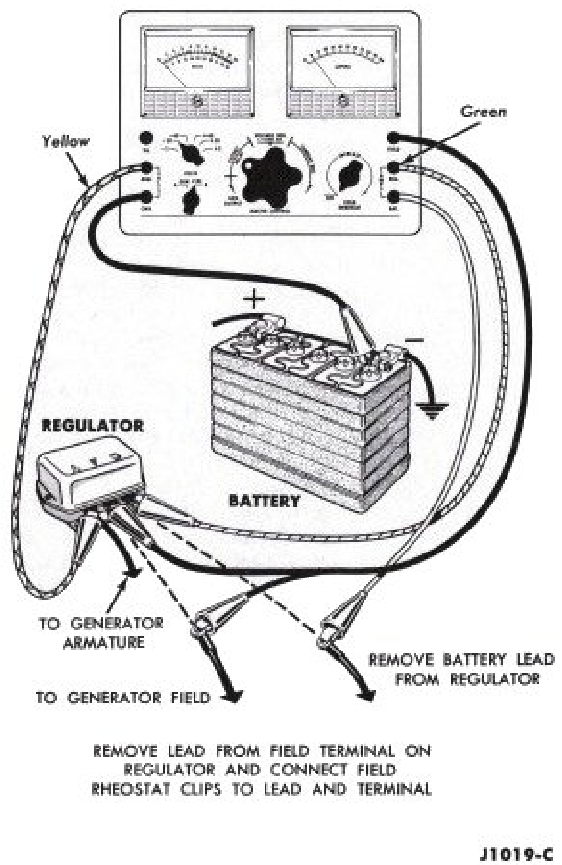


FIG. 7—Generator Regulator Test Connections—Falcon

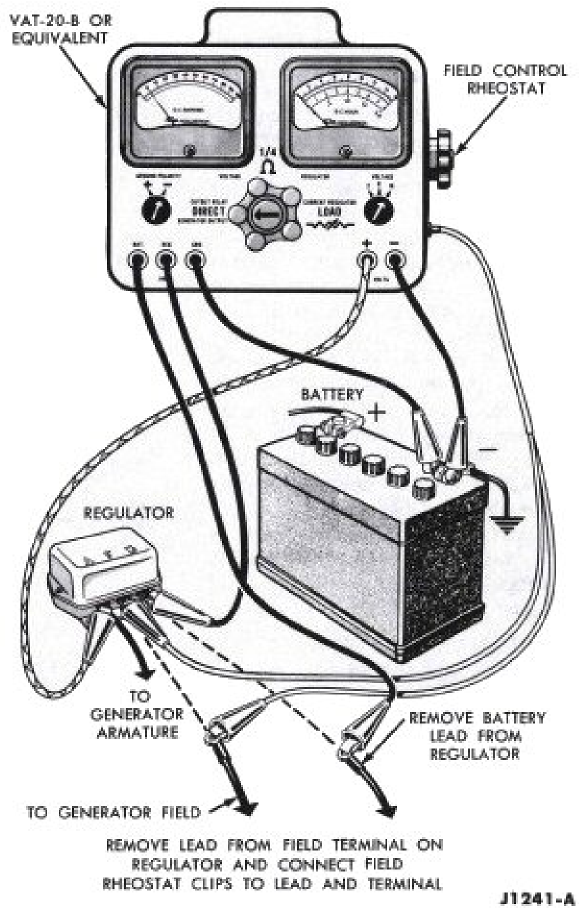


FIG. 8—Generator Regulator Test Connections—Comet

CUTOUT TEST

Start the engine and run it at approximately 1500 rpm. Decrease the resistance in the field circuit (rotate the field rheostat clockwise), and the voltage output of the generator, indicated by the voltmeter, will increase until the cutout closes. The cutout closing will be indicated by a rise of the ammeter needle and a "dip" of the voltmeter needle. The maximum voltage at the time the voltmeter needle dips or drops back will be the closing voltage of the cutout relay. This operation should be repeated to accurately determine the closing voltage of the cutout.

VOLTAGE LIMITER TEST

Rotate the field rheostat to the maximum clockwise position to reduce the resistance in the field circuit to zero. Rotate the center control to the ¼ ohm position. The ammeter should show an approximate 10 ampere load. Read the voltage regulation on the voltmeter scale. Speed the engine momentarily to see if the voltage remains regulated.

CURRENT LIMITER TEST

With the field rheostat at the maximum clockwise position, rotate the center control to the current regulator position. Continue rotating the control until the voltmeter reading drops to 13 volts. The ammeter will indicate the setting of the current limiter.

Remove all test leads except the voltmeter leads. Install the battery and field leads on the regulator terminals. Run the engine at 1500 rpm, and read the voltage regulation (under battery load) on the voltmeter. **The voltage reading will usually be low when the engine is first started because the battery is partially discharged. After a few moments of operation, the voltage will rise to the original value.**

EXTERNAL CIRCUIT RESISTANCE TEST

For the purpose of this test, the resistance values of the circuit have been converted to voltage drop readings for a current flow of 30 amperes. Connect the test equipment as shown in Fig. 9 to measure voltage drop around the circuit.

Crank the engine for 30 seconds with the ignition switch OFF to partially discharge the battery. Then start the engine and run it at approximately 1500 rpm.

Touch the voltmeter negative lead to the center of the battery positive post (Fig. 9, connections marked ①) to check the generator to battery circuit. The voltage drop should be less than 0.7 volt.

If the voltage drop in the generator to battery circuit exceeds 0.7 volt, locate the exact part of the circuit wiring causing the trouble, by contacting the voltmeter negative lead to other points of the circuit. Connect the lead to the armature terminal of the regulator (connections marked ②). The voltage drop should be less than 0.2 volt. Connect the lead to the battery terminal of the regulator (connections marked ③). The voltage reading should be less than 0.4 volt. If both these readings are within limits, the excessive resistance is in the regulator to battery wires or their connections.

Check the battery to generator ground circuit by connecting the voltmeter as shown in Fig. 9 (connections marked ④). The voltage reading should be less than 0.1 volt.

BATTERY TESTS AND CONCLUSIONS

Tests are made on a battery to determine the state of charge and also the condition. The ultimate result of these tests is to show that the battery is good, needs recharging, or must be replaced.

If a battery has failed, is low in charge, or requires water frequently, good service demands that the reason for this condition be found. It may be necessary to follow trouble shooting procedures to locate the

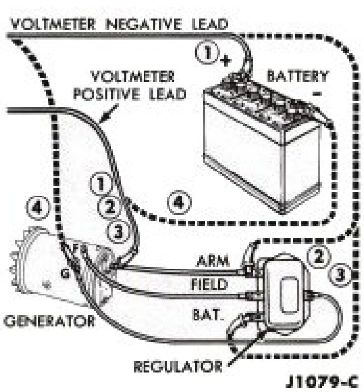


FIG. 9—Regulator External Circuit Test Connections

cause of the trouble (Section 1 in this part).

Some battery test equipment combines the necessary instruments and controls in a single unit. Be sure to follow the directions of the manufacturer when using such combined equipment.

Hydrogen and oxygen gases are produced during normal battery operation. This gas mixture can explode if flames or sparks are brought near the vent openings of the battery. The sulphuric acid in the battery electrolyte can cause a serious burn if spilled on the skin or spattered in the eyes. It should be flushed away immediately with large quantities of clear water.

BEFORE CHARGE TESTS

BATTERY CAPACITY TEST

A high-rate discharge tester in conjunction with a voltmeter is used for this test. **If the battery solution is not within 60° F. to 100° F., let it stand until warm before making this test.** Add water if necessary to bring the battery solution to the proper level. **Fill only to the narrow ring near the bottom of each vent well.** Fig. 10 shows the battery capacity test in outline form.

1. Connect the high-rate discharge tester and the appropriate voltmeter to the battery terminals.

2. Adjust the discharge tester to draw three times the ampere hour rating of the battery. After 15 seconds and with the battery still under load, read the battery terminal voltage. **The voltmeter clips must contact the battery posts and not the high rate discharge tester clips. Unless this is done the actual battery terminal voltage will not be indicated.**

3. If the terminal voltage is 9.6 volts or more, the battery has good output capacity and will accept a normal charge. Test the specific gravity if water has not been recently added, and recharge if necessary.

4. If the terminal voltage is below 9.6 volts, make a test charge on the battery.

BATTERY TEST CHARGE

The condition of a discharged battery may be tested by passing current through it.

1. Connect a fast charger to the

battery and charge the battery for 3 minutes at a rate of 30 amperes.

2. After 3 minutes of fast charge, and with the fast charger still operating, test the individual cell voltages of the battery.

3. If the cell voltages vary more than 0.1 volt, replace the battery. If the cell voltages are even within 0.1 volt, test the total battery voltage (charger still operating).

4. If the total battery voltage is now under 15.5 volts, the battery is satisfactory and may be safely fast charged (see Specifications in this Group). **Always follow the fast charge with sufficient slow charge to bring the battery to a full charge.**

5. If the total battery voltage is over 15.5 volts, the battery is probably sulphated. Place the battery on continued slow charge.

AFTER CHARGE TESTS

When the battery is fully charged (check with a hydrometer or battery charge tester) make a capacity test. If the terminal voltage is 9.6 volts or above, place the battery back in service. If the terminal voltage is below 9.6 volts, replace the battery.

BATTERY CHARGE TESTS

Battery charge may be tested by measuring the battery electrolyte solution specific gravity (hydrometer) or by measuring the voltage of the battery cells on open circuit (no current flow) with a battery charge tester (open circuit voltage tester).

A discharged 12-volt battery can freeze during cold weather. The Specifications (in this Group), shows the temperatures at which batteries of various specific gravities will begin to freeze.

BATTERY CHARGING

A battery that is not sulphated may be charged by either a fast charging or slow charging method. Most fast charge units may be adjusted for making a slow charge.

FAST CHARGING

Follow the instructions of the fast charger manufacturer, as fast chargers vary slightly with different manufacturers.

Test the battery cells for specific gravity. Then, fast charge the battery at 30 to 40 amperes maximum for the length of time shown in the specifications (in this Group), corresponding to the specific gravity condition of the battery.

SLOW CHARGING

Always follow a fast charge with a slow charge of 3 amperes for 12-volt batteries of less than 70-ampere hour capacity. Batteries of 70-ampere-hour capacity or higher require a 4 ampere slow charge. Continue the slow charge until the battery is fully charged. A battery is considered fully charged when the specific gravity readings of all the cells, taken at hourly intervals, do not increase over a 3-hour period.

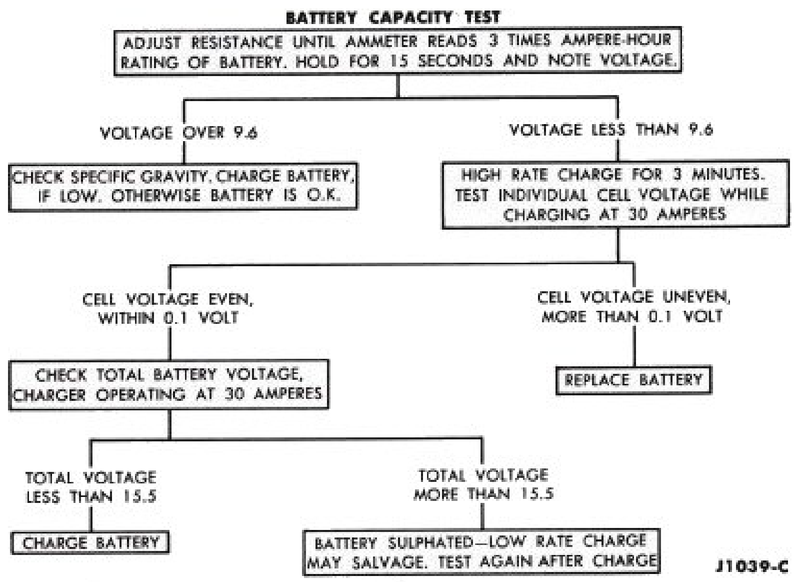


FIG. 10—Battery Capacity Test Outline

2 COMMON ADJUSTMENTS AND REPAIRS

BELT ADJUSTMENT

1. Loosen the generator-to-mounting bracket bolts and the adjusting arm bolts.

2. Apply pressure between the generator and the engine block, and tighten the adjusting arm bolt.

3. Check the belt tension using tool T63L-8620-A. Adjust the belt for specified tension.

4. Tighten all mounting bolts.

3 CLEANING AND INSPECTION

1. Wash all parts except the armature, field coils, and ball bearings in solvent and dry the parts thoroughly.

2. Wipe off the armature and field windings, the commutator, and the armature shaft.

3. Check the condition of the bearings. If the ball bearings are worn, or have lost their lubricant, they must be replaced.

4. Check the armature winding for worn insulation, overheating, and unsoldered connections.

5. Check the armature for shorts, opens or grounds.

6. Check the field windings for worn insulation and unsoldered connections at the terminal screws. Check the current draw with a 12 volt supply; if the current draw is not within specification, replace the

field winding. Resolder any connections as required.

7. Replace the armature or the field coils if the insulation is worn or if an open, short, or grounded circuit is indicated.

8. Check the commutator for runout and uneven or scored surfaces. Turn down the commutator and undercut the mica if necessary.

9. Inspect the brush end plate for poor insulation or loose rivets. Replace the end plate if the positive brush insulation is broken or cracked. Tighten any loose brush holder rivets.

10. Check the brush spring tension. If the tension is not within specifications, replace the springs.

PART 13-2 GENERATOR

1 DESCRIPTION AND OPERATION

The D.C. generating system is a negative (−) ground system. Output is controlled by a regulator which is connected between the armature and field. The field is grounded internally.

The armature shaft is supported by permanently-lubricated ball bearings which fit into the end plates (Fig. 2). The shaft is keyed to an integral pulley and cooling-fan assembly which is belt driven from the engine. The generator mounting is shown in Fig. 1.

2 IN-CAR ADJUSTMENT AND REPAIR

BELT ADJUSTMENT

1. Loosen the generator-to-mounting bracket bolts and the adjusting arm bolts.
2. Apply pressure between the generator and the engine block, and tighten the adjusting arm bolt.
3. Check the belt tension using tool T63L-8620-A. Adjust the belt for specified tension.
4. Tighten all mounting bolts.

POLARIZING GENERATORS

Normally, it is only necessary to polarize a generator when a generator has been rebuilt and if new pole shoes have been installed. Generators are polarized during manufacture, and normally, there is enough residual magnetism left to allow the generator to start charging.

To polarize a rebuilt generator mounted on the vehicle, disconnect the field wire and the battery wire from the regulator. With the engine turned off, momentarily connect the two wires together.

Do not polarize a generator by any method that applies battery voltage to the field terminal of the regulator, such as shorting from the battery terminal to the field terminal of the regulator, or by connecting a jumper wire directly from the battery to the generator field terminal. This action causes excessive current to flow from the battery through the regulator contacts to ground, thus burning the points.

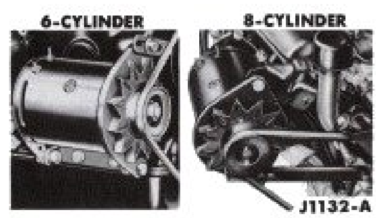


FIG. 1—Generator Mountings

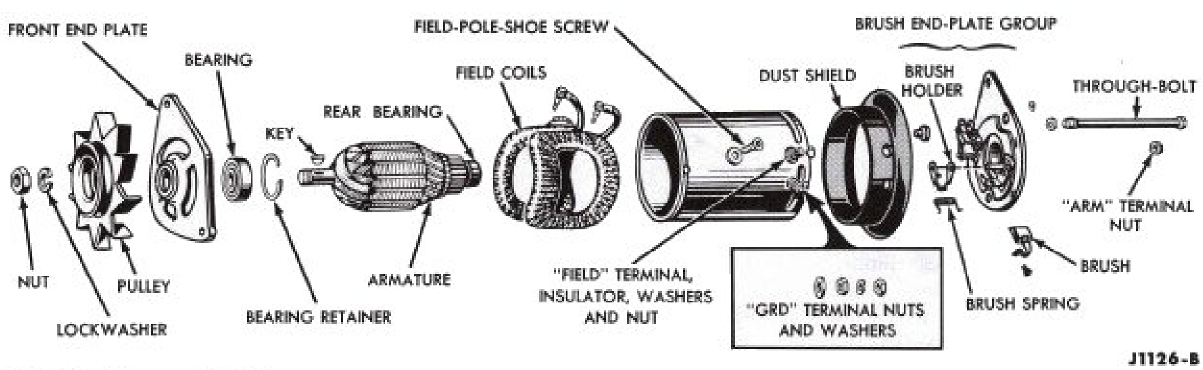


FIG. 2—Disassembled Generator

3 REMOVAL AND INSTALLATION

1. Disconnect the armature, field, and ground wires at the generator terminals.
2. Remove the adjustment arm to generator bolt, the generator belt, and the two pivot bolts from the mounting bracket. Then remove the generator (Fig. 1).
3. To install the generator, clean the mating surfaces of the generator frame and mounting bracket.
4. Install the generator in the bracket with the two pivot bolts and lockwashers.
5. Install the generator belt, and the adjustment arm to generator bolt. Adjust the belt tension and tighten all bolts securely.
6. Connect the armature, field, and ground leads on the generator terminals. Start the engine and check the generator operation.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

Fig. 2 shows a disassembled view of the generator.

1. Remove the two generator through bolts and the brush end plate. Slide the armature assembly out the other end of the frame. Do not lose the locating dowel if it drops out of the front end plate. Remove the brushes, brush arms and springs from the brush end plate.
2. Clamp the armature in a vise equipped with soft jaws, and remove the retaining nut, lockwasher, pulley and woodruff key from the armature shaft.
3. Slide the front end plate off the armature shaft. **Remove any burrs from the keyway before removing the front end plate.** Remove the bearing retainer and remove the bearing from the front end plate.
4. Remove the field and ground terminal screws from the generator frame, and unscrew the field pole shoe screws as shown in Fig. 3.
5. Slide the pole shoes and field windings out of the frame, and separate the windings and shoes.

PARTS REPAIR OR REPLACEMENT

COMMUTATOR TURNING AND UNDERCUTTING

Check the commutator runout as shown in Fig. 4. If the surface of the commutator is rough or more than 0.002 inch out of round, turn it down.

BRUSH REPLACEMENT

Replace the generator brushes if they are not within wear limits. Always change both brushes when replacement is required. If the brush wear has been excessive, check the condition of the commutator, turn it down and undercut it if necessary.

1. Remove the two through bolts from the generator frame.
2. Remove the brush end plate and the armature and front end plate assembly from the generator frame.
3. Disconnect the brush terminals and remove the brushes.
4. Clean the carbon and dirt from the brush end plate. Repair or replace the insulation between the brush holders and end plate and the armature terminal and end plate if it is worn or cracked. Clean the commutator with sandpaper.
5. Make sure that the new brushes slide freely in the brush holders. Seat the new brushes by sanding them in as shown in Fig. 5. Attach the brush terminals.
6. Retract the brushes until the brush springs ride against the side of the brushes, to retain them in the retracted position.
7. Install the armature and front end plate assembly and the brush end plate (aligning the dowel and locating boss and the frame slots).
8. Install the through bolts with lockwashers.
9. Use a piece of stiff wire with a hooked end to reach through the ventilating slots and position the brush arms on top of the brushes.

ARMATURE REPLACEMENT

1. Remove the two through bolts and the brush end plate, and then slide the armature and front end plate assembly out of the frame. On the Delco Remy generator, remove the through bolts and slide the front end plate and armature out of the frame.
2. Clamp the armature in a vise equipped with soft jaws, and remove the retaining nut, lockwashers, pulley, and woodruff key.
3. Remove any burrs or scratches from the keyway or shaft, and slide the front end plate off the shaft.
4. Install the front end plate on the new armature.
5. Install the woodruff key, pulley, lockwasher, and retaining nut.
6. Install new brushes in the brush end plate, retract the brushes, until the brush springs ride against the side of the brushes, to retain them in the retracted position.
7. Slide the armature and front end plate assembly into the frame, aligning the dowel with the frame slot.
8. Install the end plate (aligning the dowel and the frame slot) and install the through bolts with lock-washers and nuts.
9. Use a piece of stiff wire with a hooked end to reach through the ventilating slots, and position the brush springs on top of the brushes.

ASSEMBLY

1. Install the field coils on the pole shoes, and mount the shoe and coil assemblies in the frame.
2. Tighten the field pole shoe screws (Fig. 3). **As the screws are tightened, strike the frame several sharp blows with a soft faced hammer to seat and align the pole shoes. Stake the screws.**
3. Install the field and ground terminal screws, washers, and nuts in the frame.

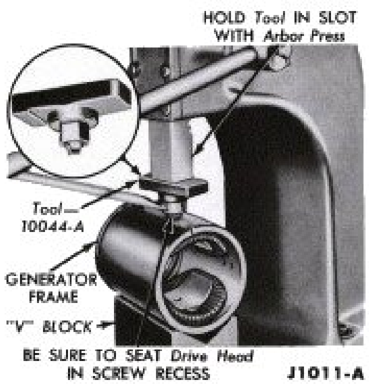


FIG. 3—Pole Shoe Screw Removal

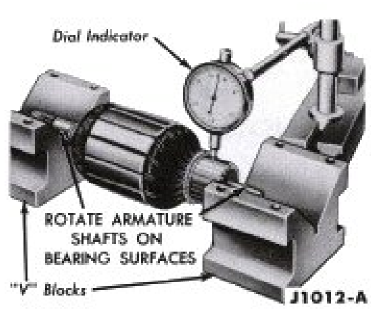


FIG. 4—Commutator Runout Check

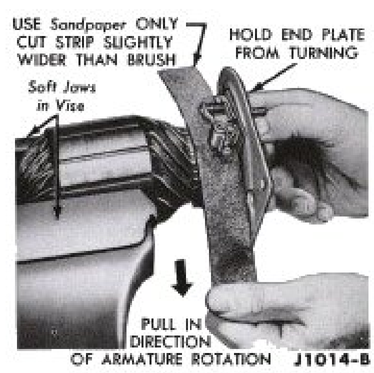


FIG. 5—Generator Brush Seating

4. Install the brush arms and springs. Insert new brushes in the brush holders and seat them (Fig. 5).

5. Move the brushes back in the holders until the brush springs ride against the side of the brushes to retain them in the retracted position.

6. Install the bearing in the front end plate and install the bearing retainer.

7. Slide the plate on the armature shaft (with the retainer toward the armature windings), and install the woodruff key, pulley, lockwasher and retaining nut.

8. Install the armature and front end plate assembly in the frame, locating the dowel in the frame groove.

9. Install the brush end plate (aligning the locating boss and frame groove), and install the through bolts with lockwashers and nuts.

10. Use a piece of stiff wire with a hooked end to reach through the ventilating slots, and position the brush springs on top of the brushes.

PART 13-3 GENERATOR REGULATOR

1 DESCRIPTION AND OPERATION

The generator regulator is composed of three control units mounted as an assembly (Fig. 1). Each unit has a set of contact points and an energizing coil for operating the points, and each of the units performs a separate function to maintain control of the generator.

CUTOUT RELAY

When the engine is not operating, the contact points on the cutout relay (Fig. 1), are held open by spring tension.

At approximately 12 volts, the coil is energized sufficiently to overcome the spring tension and close the cutout points, connecting the generator to the external load.

VOLTAGE LIMITER RELAY

The voltage limiter holds the generator voltage below a predetermined setting by controlling the amount of voltage applied to the field coils. The voltage limiter thus protects the battery, lights, ignition system etc., from high voltage when the system load demand is low.

CURRENT LIMITER RELAY

The current limiter relay protects the generator armature windings by limiting the maximum amount of current supplied by the generator. Like the voltage limiter, the current limiter performs its function by controlling the amount of current that is supplied to the generator field coils. The current limiter thus protects the generator when the system load demand is high.

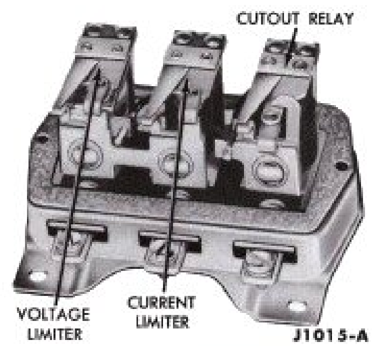


FIG. 1—Generator Regulator

TEMPERATURE COMPENSATION

The generator regulator has been designed to exercise automatic control over the generating system, and also to compensate for seasonal temperature changes. In cold weather a higher voltage output is required to handle the load. In warmer weather, the voltage must be reduced to avoid over charging the battery. The temperature compensation is built into the regulator unit by making the armature hinge of bi-metal. The temperature sensitivity of the bi-metal causes the regulator voltage setting to change according to temperature.

FIG. 2—Voltage Regulation Setting Thermometer

Therefore, it is necessary to establish a "normal" or stabilized regulator operating temperature to coincide with the specified voltage setting of 14.6 to 15.4 volts. The standard ambient air temperature established for this setting is 70° to 80° Fahrenheit. The regulator temperature for this or any setting, is defined as the temperature of the regulator after ½ hour of operation in the car or, after the regulator has been heated until it becomes stabilized.

For correct voltage regulation adjustment, first be sure that the regulator has reached 'Normal" operating temperature as defined above; then make the voltage adjustment setting to coincide with the prevailing, ambient air temperature. The specifications section shows the proper voltage limits for various ambient air temperatures.

ON THE CAR

On the car, ambient air temperature will be the temperature of the engine compartment air. To measure the air temperature, first clip the voltage regulation setting thermometer onto the regulator cover (Fig. 2).

When checking or adjusting the

heavy-duty regulators, observe the temperature indicated by the thermometer and refer to the Specifications Section for the correct voltage setting.

Run the engine to stabilize the regulator. The engine fan will cause the air in the engine compartment to circulate past the regulator until the regulator has stabilized at the ambient air temperature. After the regulator and thermometer have stabilized, the thermometer will show the voltage setting at which the regulator should be operating.

ON THE TEST BENCH

When the regulator is mounted on a regulator test bench, the ambient air temperature will be the room temperature. Clip the voltage regulator setting thermometer onto the regulator cover (Fig. 2). Mount a small fan on the regulator test bench about 12 to 15 inches from the regulator. Operate the fan and the regulator to stabilize the regulator. The fan will provide sufficient air flow to ensure stabilization of the regulator at the temperature indicated by the thermometer. After stabilization, the thermometer will show the voltage setting at which the regulator should be operating.

2 IN-CAR ADJUSTMENT AND REPAIR

REGULATOR ELECTRICAL ADJUSTMENT

The adjustment of the regulator must be checked with the regulator at normal operating temperature, the battery fully charged, and the engine operating at 1500 rpm.

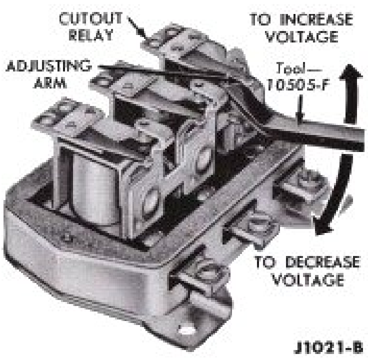


FIG. 3—Cut-In Voltage Adjustment

ADJUST CUT-IN VOLTAGE

The regulator cut-in voltage is increased by bending the adjusting arm upward, or decreased by bending it downward (Fig. 3).

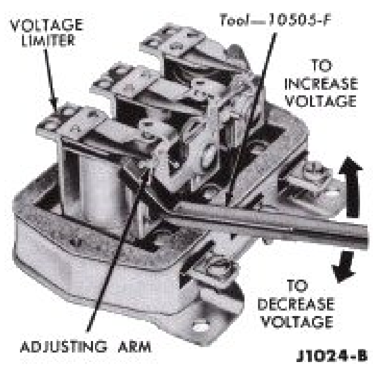


FIG. 4—Voltage Limiter Adjustment

ADJUST VOLTAGE LIMITER

Make a regulator voltage setting test with the cover on. If the regulator voltage is not within the limits as shown in the specifications, for the ambient temperature involved, compute the difference as a positive or negative correction. Remove the regulator cover and make a new regulator voltage limit test. Adjust the new setting either up or down by the amount of the correction just computed.

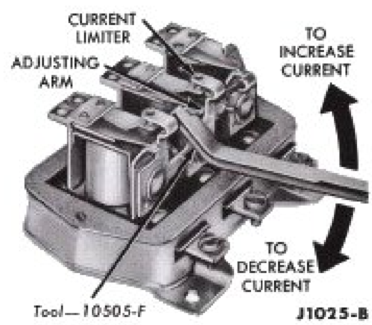


FIG. 5—Current Limiter Adjustment

To increase the voltage setting, increase the spring tension by bending the adjusting arm upward (Fig. 4). To decrease the voltage, bend the adjusting arm downward. Check the voltage setting with the regulator cover replaced.

ADJUST CURRENT LIMITER

If the current limit is less than that specified, increase the spring tension by bending the current limiter adjusting arm upward (Fig. 5). To decrease the current limit, bend the adjusting arm downward. Install the cover.

3 REMOVAL AND INSTALLATION

REGULATOR REPLACEMENT

Disconnect the battery ground cable. Disconnect the armature, field, and battery leads at the regulator terminals. Remove the mounting screws and the regulator. **Always disconnect a battery cable when working on the regulator to prevent an accidental short circuit of the battery lead to ground.**

To install the regulator, place it in position and install the mounting screws. Mount the ground wire terminal under the mounting screw at the back of the regulator. Connect the armature, field, battery, and radio suppression condenser leads to the regulator terminals (Fig. 6). Connect the battery ground cable.

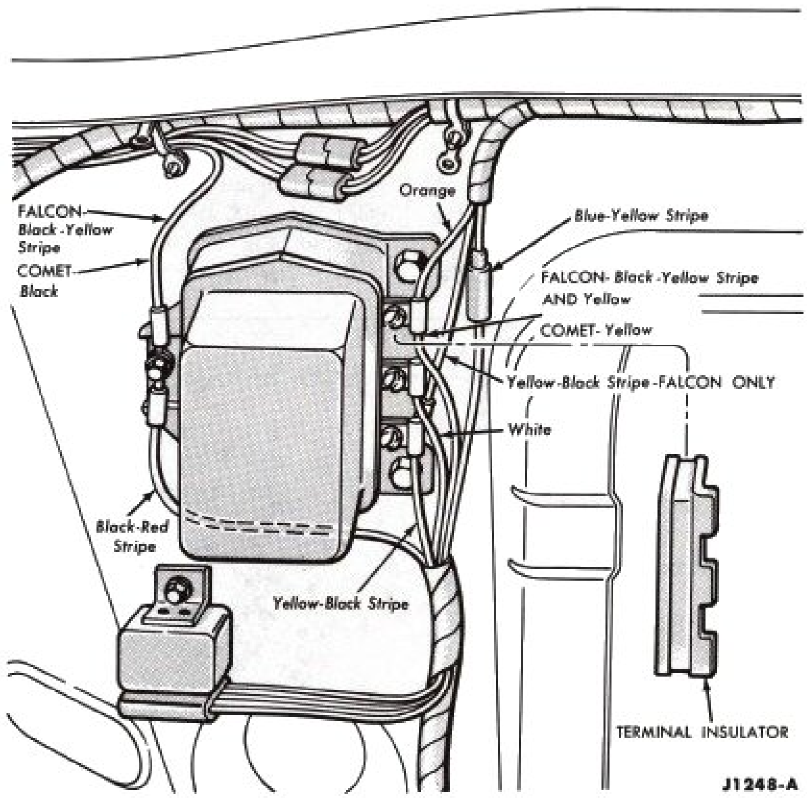


FIG. 6—Regulator Mounting

PART 13-4 SPECIFICATIONS

GENERATOR

Vendor	Amperes (@ 15V.)	Watts (@ 15V.)	Field Current (Amps. @ 12V. 75° F.)	Cut-in Speed (Generator rpm)*	Rated Output Speed (Generator rpm)*	Belt Width (Inches)	Belt Tension (Pounds)†	BRUSHES Number Used	Original Length (Inches)	Wear Limit (Inches)	Spring Tension (Ounces)
FORD	30	450	1.0-1.5	950	3400 Cold 6500 Hot	3/8	60-90	2	7/8	5/16	20-26

*To find the equivalent engine rpm, divide the generator pulley diameter by the crankshaft pulley diameter and then multiply by the generator rpm.

†Used Belt tension on all engines except 260 h.p. which is 80-110 lbs. New Belt tension is 90-120 lbs. on all engines except 260 h.p. which is 110-140 lbs. A used belt is one that has been in operation for more than 10 minutes.

REGULATOR

Vendor	Current Rating	Voltage Regulation @ 75° F.	CURRENT LIMITER Amperes	CURRENT LIMITER Contact Gap (Inches)	CURRENT LIMITER Air Gap (Inches)	VOLTAGE LIMITER Contact Gap (Inches)	VOLTAGE LIMITER Air Gap (Inches)	CUT OUT Contact Gap (Inches)	CUT OUT Air Gap (Inches)	CUT OUT Reverse Current to Open (Amp.)	CUT OUT Closing Volts
Ford	Used with 25 Amp. Ford Generator	14.6-15.4	23-27	—	0.033-0.036	—	0.033-0.036	0.017-0.022	0.008-0.012	8 Max.	12.4-13.2
Ford	Used with 30 Amp. Ford Generator	14.6-15.4	28-32	—	0.033-0.036	—	0.033-0.036	0.017-0.022	0.008-0.012	8 Max.	12.2-13.2

BATTERY FREEZING TEMPERATURES

Specific Gravity	Freezing Temperature
1.280	−90°F.
1.250	−62°F.
1.200	−16°F.
1.150	+ 5°F.
1.100	+19°F.

VOLTAGE REGULATION SETTING

Ambient Temperature °F.	Standard Ford Generator Regulator
25	15.1-15.9
35	15.0-15.8
45	14.9-15.7
55	14.8-15.6
65	14.7-15.5
75	14.6-15.4
85	14.5-15.3
95	14.3-15.1
105	14.2-15.0
115	14.1-14.9
125	13.9-14.7
135	13.8-14.6
145	13.6-14.4

STARTING SYSTEM

GROUP 14

PART 14-1 GENERAL STARTING SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

If the engine cranks but will not start, the trouble is in the engine (fuel, or ignition system) and not in the starting system. If the engine will not crank even with a booster battery connected, engine parts may be seized or the starter may be faulty. If it still will not start, push or tow the car to the shop for a complete diagnosis.

Do not push or tow a car equipped with an automatic transmission for more than 12 miles without raising the rear wheels off the ground or disconnecting the driveshaft.

STARTER TROUBLE DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK AND STARTER RELAY DOES NOT CLICK	1. The battery may be discharged. 2. The ignition switch, starter neutral switch or starter relay may be inoperative. 3. The circuit may be open or contain high resistance. **CHECK BATTERY** Perform a "Battery Capacity Test." If the battery does not test as having good capacity, make a "Battery Test Charge." Replace the battery if the test indicates that it is worn out or under capacity. **CHECK STARTER RELAY** 1. Disconnect and ground the high tension lead from the spark coil so that the engine cannot start. On cars with a transistor ignition, also disconnect the brown wire from the starter relay I terminal. Place the transmission lever in the "N" or "P" position. 2. With a fully charged battery, operate the starter switch to crank the engine. If the engine will not crank and the relay does not click, connect a jumper lead from the battery terminal of the relay to the starter switch terminal of the relay (Fig. 2, connection ①). If the engine does not crank, the starter relay is probably defective. 3. If the engine cranks in Step 2, remove the quick disconnect from the starter neutral switch, which is located on the steering column under the instrument panel. Connect a jumper wire between the quick disconnect terminals that are connected to the two red-blue stripe wires. Operate the starter switch to crank the engine. 4. If the engine cranks in Step 3, the starter neutral switch is defective or out of adjustment. 5. If the engine does not crank in Step 3, there are three possible defects: The wire from the battery termi-

CONTINUED ON NEXT PAGE

STARTER TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE WILL NOT CRANK AND STARTER RELAY DOES NOT CLICK (Continued)	nal of the ignition switch to the battery terminal of the starter relay is loose or broken. The ignition switch starter terminal is defective. The wire from the starter switch to the automatic transmission neutral switch or from the neutral switch to the starter relay is loose or broken.
ENGINE WILL NOT CRANK BUT STARTER RELAY CLICKS	If the relay clicks when the ignition switch is operated, connect a heavy jumper from the relay battery terminal to the relay starter motor terminal (Fig. 1, connection ②). If the engine cranks, replace the relay. If the engine does not crank, observe the spark when connecting and disconnecting the jumper. If there is a heavy spark, see "Check Engine and Starter Drive" below. If the spark is weak or if there is no spark at all, proceed as follows: **CHECK CABLES AND CONNECTIONS** If the spark at the relay is weak when the jumper is connected, inspect the battery starter cables for corrosion and broken conductors. Check the ground cable to see if it is broken or badly corroded. Inspect all cable connections. Clean and tighten them if necessary. Replace any broken or frayed cables. If the engine still will not crank, the trouble is in the starter, and it must be repaired or replaced. **CHECK ENGINE AND STARTER DRIVE** If a heavy spark is obtained when the jumper wire is connected, loosen the starter mounting bolts to free the starter pinion. If the starter drive is locked, remove the starter from the engine and examine the starter drive pinion for burred or worn teeth. Examine the teeth on the flywheel ring gear for burrs and wear. Replace the pinion or the flywheel ring gear if they are worn or damaged. If the starter drive is not locked, remove the starter from the engine and perform the no-load current test. The starter should run freely. If the current reading at no-load speed is below specifications, the starter has high resistance and should be repaired. If the current reading is above normal, and the starter is running slower than it should at no-load, it is probably due to tight or defective bearings, a bent shaft, or the armature rubbing the field poles. A shorted coil in the starter also causes the current reading to be high. Disassemble the starter and determine the cause. Repair it if possible, or replace the starter. If the no-load current reading of the starter is normal, install the starter, remove all the spark plugs, and attempt to crank the engine with the starter. If the engine cranks with the spark plugs removed, water has probably leaked into the cylinders causing a hydrostatic lock. The cylinder heads must be removed, and the cause of internal coolant leakage eliminated. If the engine will still not crank, the engine is seized and cannot be turned by the starter. Disassemble the engine and repair or replace the defective parts.
STARTER SPINS BUT DOES NOT CRANK THE ENGINE	If the starter spins but will not crank the engine, the starter drive is worn or dirty and is sticking on the starter shaft or is broken. Clean or repair the starter drive as required.
ENGINE CRANKS SLOWLY	Several causes may result in this symptom: 1. The battery may be low in charge. 2. There may be excessive resistance in the starter circuit. 3. The starter may be faulty. 4. The engine may have excessive friction. **CHECK BATTERY** Test the state of charge of the battery. If the battery is discharged, recharge the battery, and check the starter relay for possible internal shorts to ground that may have caused the battery to discharge. Perform a "Battery Capacity Test"

CONTINUED ON NEXT PAGE

STARTER TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS SLOWLY (Continued)	(page 13-4). If the battery does not test as having good capacity, make a "Battery Test Charge" (page 13-4). Replace the battery if the test indicates it to be worn out or under capacity. **CHECK EXTERNAL CIRCUIT VOLTAGE DROP** If the battery was fully charged in the previous test, test the starter cranking circuit voltage drop. The voltage drop will be either excessive or normal. **VOLTAGE DROP (RESISTANCE) EXCESSIVE** Locate the exact part of the circuit with the excessive resistance. To correct excessive resistance in the battery to starter relay cable, starter relay to starter cable or battery to ground cable, clean and tighten the cable connections. Re-	check the voltage drop. If it is still excessive, replace the cables. To correct excessive resistance of the starter relay contacts, replace the starter relay. **VOLTAGE DROP (RESISTANCE) NORMAL** If the voltage drop (resistance) is normal, make a starter load test. If the starter current is below specifications, proceed as follows: **Cranking Current Low.** Remove the starter from the engine, and repair or replace it. **Cranking Current Normal or High.** Test the starter current draw at no-load. If the no-load current draw is above or below specifications, repair or replace the starter. If the current draw at no-load is normal, the starter is not at fault. The engine has excessive friction, and the cause must be determined. Repair or replace faulty parts.

STARTER LOAD TEST

Connect the test equipment as shown in Figs. 2 or 3. Be sure that no current is flowing through the ammeter and heavy-duty carbon pile rheostat portion of the circuit (rheostat at maximum resistance).

Crank the engine with the ignition OFF, and determine the exact reading on the voltmeter. This test is accomplished by disconnecting and grounding the high tension lead from the spark coil, and by connecting a jumper from the battery terminal of the starter relay to the ignition switch terminal of the relay.

Stop cranking the engine, and reduce the resistance of the carbon pile until the voltmeter indicates the same reading as that obtained while the starter cranked the engine. The ammeter will indicate the starter current draw under load.

STARTER NO-LOAD TEST

The starter no-load test will uncover such faults as open or shorted windings, rubbing armature, and bent armature shaft. The starter can be tested, at no-load, on the test bench only.

Make the test connections as shown in Figs. 4 or 5. The starter will run at no-load. Be sure that no current is flowing through the ammeter (rheostat at maximum counterclockwise position). Determine the exact reading on the voltmeter.

Disconnect the starter from the battery, and reduce the resistance of the rheostat until the voltmeter indicates the same reading as that obtained while the starter was running. The ammeter will indicate the starter no-load current draw.

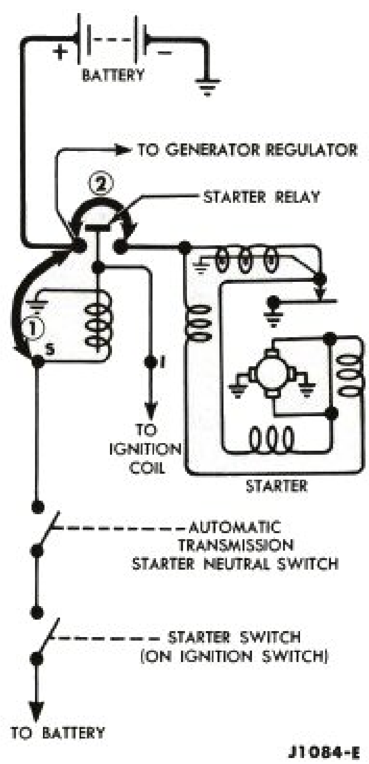


FIG. 1—Starting Control Circuit Test

ARMATURE OPEN CIRCUIT TEST—ON TEST BENCH

An open circuit armature may sometimes be detected by examining the commutator for evidence of burning. The spot burned on the commutator is caused by an arc formed every time the commutator segment, connected to the open circuit winding, passes under a brush.

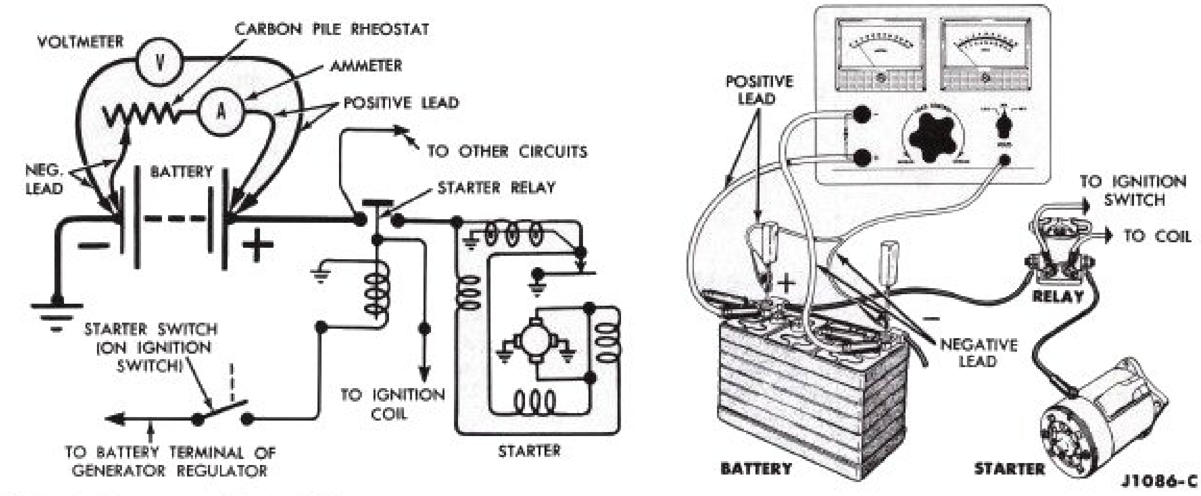


FIG. 2—Starter Load Test—Falcon

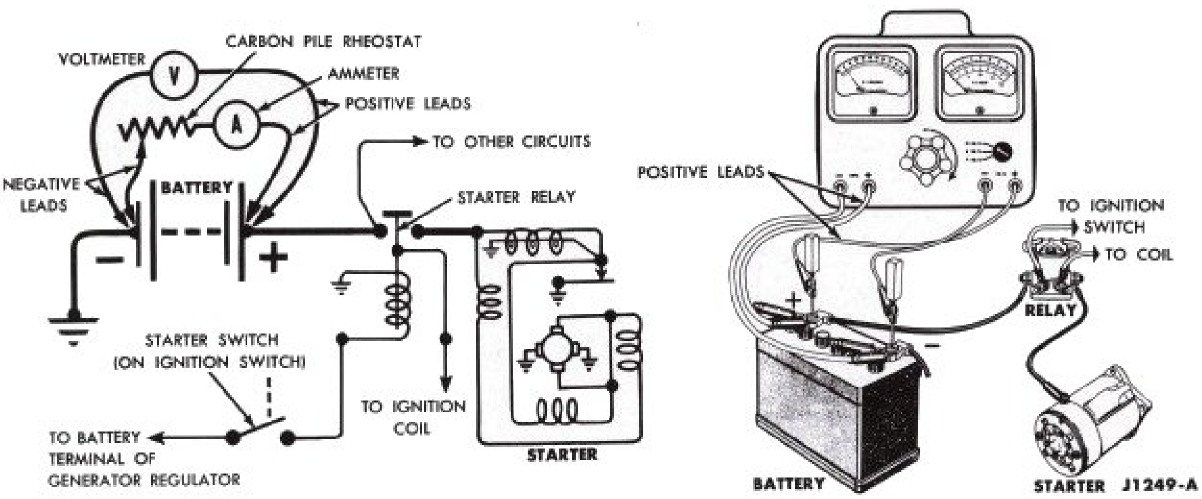


FIG. 3—Starter Load Test—Comet

ARMATURE AND FIELD GROUNDED CIRCUIT TEST—ON TEST BENCH

This test will determine if the winding insulation has failed, permitting a conductor to touch the frame or armature core.

To determine if the armature windings are grounded, make the connections as shown in Fig. 6. If the voltmeter indicates any voltage, the windings are grounded.

Grounded field windings can be detected by making the connections as shown in Fig. 7. If the voltmeter indicates any voltage, the field windings are grounded.

STARTER CRANKING CIRCUIT TEST

Excessive resistance in the starter circuit can be determined from the results of this test. Make the test connections as shown in Fig. 8. Crank the engine with the ignition OFF. This is accomplished by disconnecting and grounding the high tension lead from the spark coil and by connecting a jumper from the battery terminal of the starter relay to the ignition switch terminal of the relay.

The voltage drop in the circuit will be indicated by the voltmeter (0 to 1 volt range). Maximum allowable voltage drop should be:

1. With the voltmeter negative lead connected to the starter terminal and the positive lead connected to the battery positive terminal (Fig. 8, connection ①) . . 0.5 volt.

2. With the voltmeter negative lead connected to the battery terminal of the starter relay and the positive lead connected to the posi-

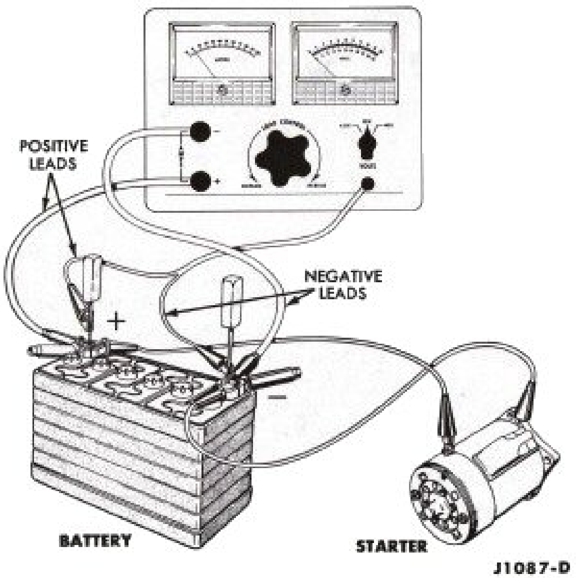


FIG. 4—Starter No-Load Test on Test Bench—Falcon

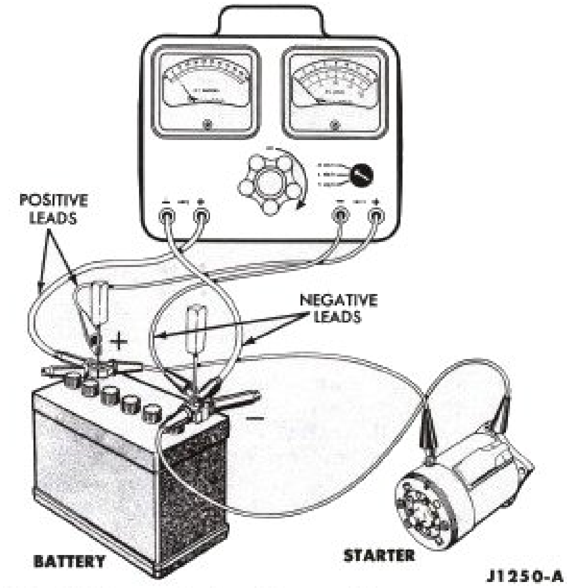


FIG. 5—Starter No-Load Test on Test Bench—Comet

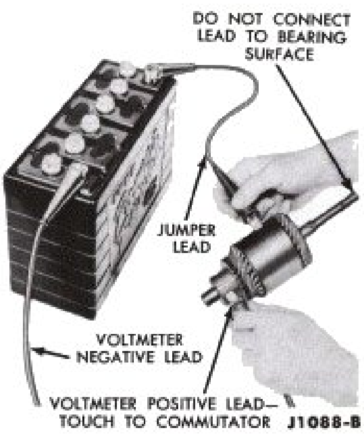


FIG. 6—Armature Grounded Circuit Test

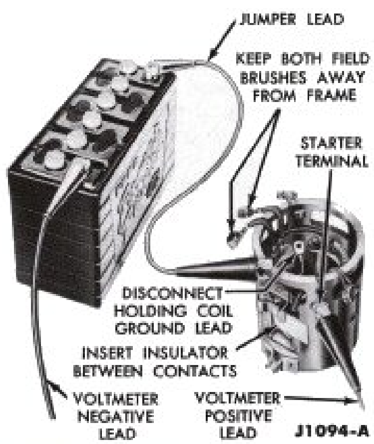


FIG. 7—Field Grounded Circuit Test

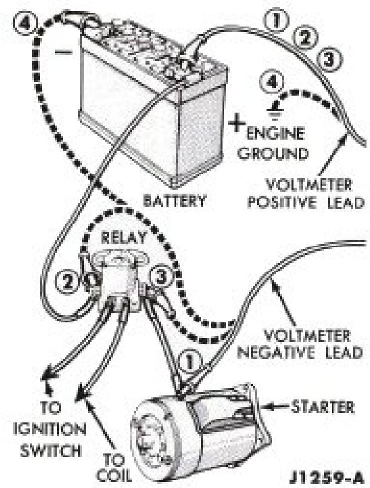


FIG. 8—Starter Cranking Circuit Test

tive terminal of the battery (Fig. 8, connection ②) . . . . 0.1 volt.

3. With the voltmeter negative lead connected to the starter terminal of the starter relay and the positive lead connected to the positive terminal of the battery (Fig. 8, connection ③) . . . . 0.3 volt.

4. With the voltmeter negative lead connected to the negative terminal of the battery and the positive lead connected to the engine ground (Fig. 8, connection ④) . . . 0.1 volt.

2 COMMON ADJUSTMENTS AND REPAIRS

STARTER DRIVE REPLACEMENT

1. Loosen and remove the brush cover band and the starter drive actuating lever cover.

2. Loosen the through bolts enough to allow removal of the drive gear housing and the starter drive actuating lever return spring.

3. Remove the pivot pin retaining the starter drive actuating lever and remove the lever.

4. Remove the drive gear stop ring retainer and stop ring from the end of the armature shaft and remove the drive gear assembly.

5. Apply a thin coating of Lubriplate 777 on the armature shaft

splines. Install the drive gear assembly on the armature shaft and install a new stop ring.

6. Position the starter gear actuating lever on the starter frame and install the retaining pivot pin. **Be sure that the actuating lever properly engages the starter drive assembly.**

7. Install a new retaining clip retainer. Position the starter drive actuating return spring and drive gear housing to the starter frame, and then tighten the through bolts to specification.

8. Position the starter drive actuating lever cover and the brush cover band, with gasket, on the starter. Tighten the brush cover band retaining screw.

BRUSH REPLACEMENT

Replace the starter brushes when they are worn to half size. Always install a complete set of new brushes.

1. Loosen and remove the brush cover band and starter drive actuating lever cover. Remove the brushes from their holders.

2. Remove the two through bolts from the starter frame.

3. Remove the drive gear housing, and the actuating lever return spring.

4. Remove the starter drive actuating lever pivot retaining pin and lever, and remove the armature.

5. Remove the brush end plate.

6. Remove the ground brush retaining screws from the frame and remove the brushes (cut the ground brush nearest the starter terminal from the brush terminal block, as close to the brush lead terminal as possible).

7. Unsolder (or cut) the insulated brush leads from the field coils, as close to the field connection point as possible.

8. Clean and inspect the starter motor.

9. Replace the brush end plate if the insulator between the field holder brush and the end plate is cracked or broken.

10. Solder the new field brushes to the field coils using rosin core solder (Fig. 6, Part 14-2). Use a 300 watt iron.

11. Install the ground brush leads to the frame with the retaining screws.

12. Clean the commutator with #00 or #000 sandpaper.

13. Position the brush end plate to the starter frame, with the end plate boss in the frame slot.

14. Position the fiber washer on the commutator end of the armature shaft and install the armature in the starter frame.

15. Install the starter drive gear actuating lever to the frame and starter drive assembly, and install the pivot pin.

16. Position the return spring on the actuating lever and the drive gear housing to the starter frame. Install the through bolts and tighten to specified torque. Be sure that the snap ring retainer is seated properly in the drive gear housing.

17. Install the commutator brushes in the brush holders. Center the brush springs on the brushes.

18. Position the actuating lever cover and the brush cover band, with gasket, on the starter. Tighten the band retaining screw.

19. Check the starter no-load current draw.

ARMATURE REPLACEMENT

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive actuating lever cover. Remove the brushes from their holders.

2. Remove the through bolts, starter drive gear housing, and the starter drive actuating lever return spring.

3. Remove the pivot pin retaining the starter gear actuating lever, and remove the lever.

4. Remove the armature. If the starter drive gear assembly is being reused, remove the stop ring retainer and the stop ring from the end of the armature shaft, and remove the assembly.

5. Place the starter drive gear assembly on the new armature with a new stop ring.

6. Install the fiber thrust washer on the commutator end of the armature shaft and install the armature.

7. Position the starter gear actuating lever to the frame and drive gear assembly and install the retaining pivot pin.

8. Position the starter drive actuating lever return spring, starter drive gear housing, and the brush plate to the starter frame, and then install and tighten the through bolts to specification. Be sure that the stop ring retainer is seated properly in the drive gear housing.

9. Place the brushes in their holders, and center the brush springs on the brushes.

10. Position the actuating lever cover and the brush cover band, with gasket, and then tighten the retaining screw.

COMMUTATOR TURNING

Check the commutator runout as shown in Fig. 9. If the surface of the commutator is rough, or more than 0.005 inch out-of-round, turn it down.

3 CLEANING AND INSPECTION

1. Use a brush or air to clean the field coils, armature, commutator, and armature shaft. Wash all other parts in solvent and dry the parts.

2. Inspect the armature windings for broken or burned insulation and unsoldered connections.

3. Check the armature for open circuits and grounds.

4. Check the commutator for runout (Fig. 9), and inspect the armature shaft and the two bearings for scoring and excessive wear. If the commutator is rough, or more than 0.005 inch out-of-round, turn it down.

5. Check the brush holders for broken springs and the insulated brush holders for shorts to ground. Tighten any rivets that may be loose. Replace the brushes if worn to $\frac{5}{16}$ inch in length.

6. Check the brush spring tension. Replace the springs if the tension is not within specified limits.

7. Inspect the field coils for burned or broken insulation and continuity. Check the field brush solder connections and lead insulation.

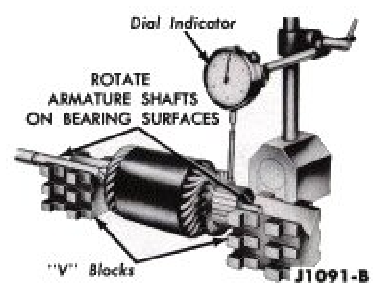


FIG. 9—Commutator Runout Check

PART 14-2 FORD POSITIVE ENGAGEMENT STARTER

1 DESCRIPTION AND OPERATION

The function of the starting system is to crank the engine at a high enough speed to permit it to start. The system includes the starter motor and drive, the battery, a remote control starter switch, and heavy circuit wiring.

The starter mounting is shown in Fig. 1. Figure 3 shows the starting circuit schematic.

The starter utilizes an integral positive-engagement drive (Fig. 2). When the starter is not in use, one of the field coils is connected directly to ground through a set of contacts (Fig. 3). When the starter is first connected to the battery a large current flows through the grounded field coil, actuating a movable pole shoe. The pole shoe is attached to the starter drive actuating lever, and thus the drive is forced into engagement with the flywheel.

When the movable pole shoe is fully seated, it opens the field coil grounding contacts and the starter is then in normal operation. A holding coil is used to maintain the movable pole shoe in the fully seated position, during the time that the starter is turning the engine.

Cars equipped with an automatic transmission have a starter neutral switch, in the starter control circuit, which prevents operation of the starter if the selector lever is not in the "N" (neutral) or "P" (park) position.

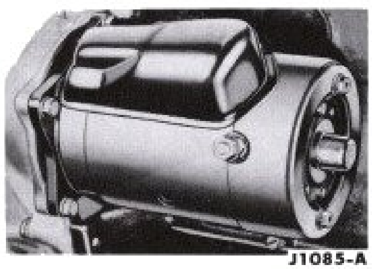


FIG. 1—Starter Mounting

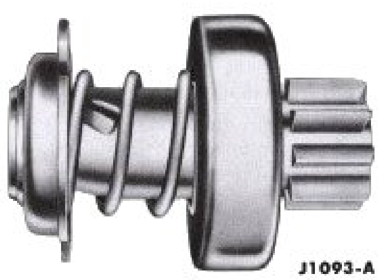


FIG. 2—Starter Drive

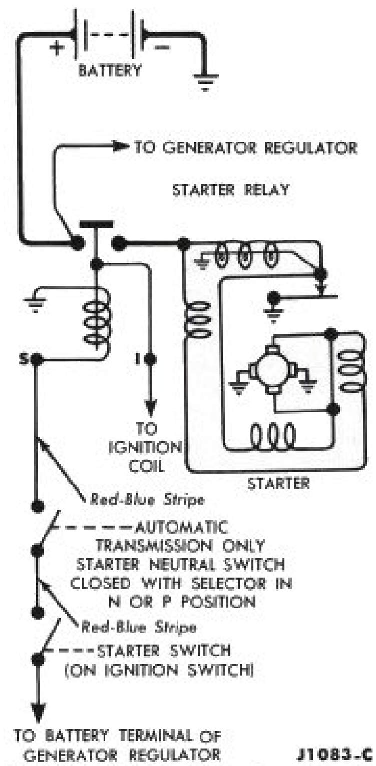


FIG. 3—Starting Circuit Schematic

2 REMOVAL AND INSTALLATION

STARTER REPLACEMENT

1. Disconnect the starter cable at the starter terminal.
2. Remove the flywheel housing to starter retaining screws. Remove the starter assembly.
3. Position the starter assembly to the flywheel housing, and start the mounting bolts.
4. Snug all bolts, then torque them to 12-15 ft-lbs, tightening the middle bolt first.
5. Connect the starter cable.

3 MAJOR REPAIR OPERATIONS

Use the following procedure when it becomes necessary to completely overhaul the starter. Figure 4 illustrates a partially disassembled starter.

DISASSEMBLY

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive actuating lever cover. Observe the lead dress for assembly and then remove the commutator brushes from the brush holders.

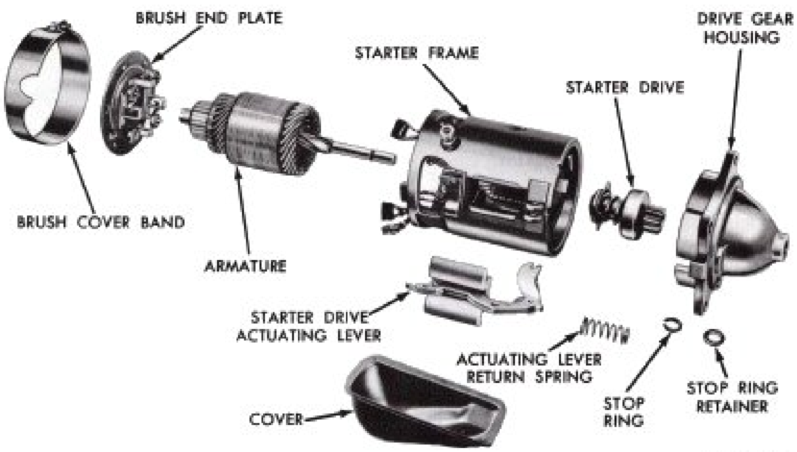


FIG. 4—Starter Disassembled

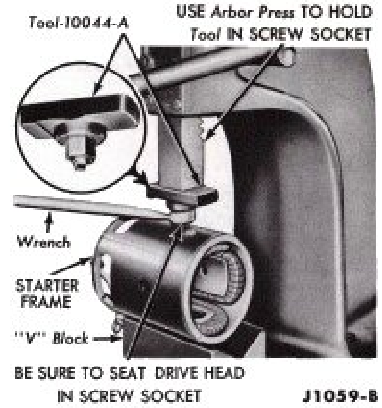


FIG. 5—Pole Shoe Screw Removal

2. Remove the through bolts, starter drive gear housing, and the starter drive actuating lever return spring.

3. Remove the pivot pin retaining the starter gear actuating lever and remove the lever and the armature.

4. Remove the stop ring retainer. Remove and discard the stop ring retaining the starter drive gear to the end of the armature shaft, and remove the starter drive gear assembly.

5. Remove the brush end plate.

6. Remove the two screws retaining the ground brushes to the frame.

7. On the field coil that operates the starter drive gear actuating lever, bend the tab up on the field retainer and remove the field coil retainer.

8. Remove the three coil retaining screws, using tool #10044-A and an arbor press (Fig. 5). The arbor press prevents the wrench from slipping out of the screw. Unsolder the field coil leads from the terminal screw, and remove the pole shoes and coils from the frame (use a 300-watt iron).

9. Remove the starter terminal nut, washer, insulator and terminal from the starter frame. Remove any excess solder from the terminal slot.

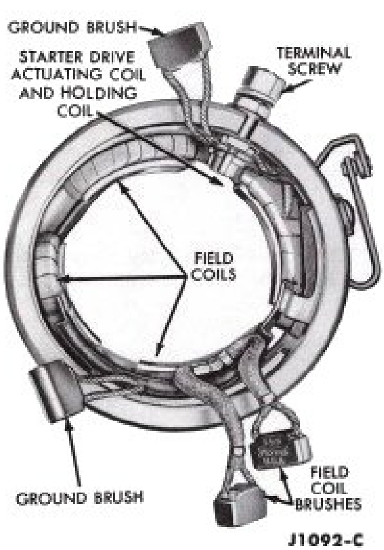


FIG. 6—Field Coil Assembly

PARTS REPAIR OR REPLACEMENT

Nicks and scratches may be removed from the commutator by turning it down. All other assemblies are to be replaced rather than repaired.

ASSEMBLY

1. Install the starter terminal, insulator, washers, and retaining nut in the frame (Fig. 6). Be sure to position the slot in the screw perpendicular to the frame end surface.

2. Position the coils and pole pieces, with the coil leads in the terminal screw slot, and then install the retaining screws. As the pole shoe screws are tightened, strike the frame several sharp blows with a soft-faced hammer to seat and align the pole shoes, then stake the screws.

3. Install the solenoid coil and retainer and bend the tabs to retain the coils to the frame.

4. Solder the field coils and solenoid wire to the starter terminal using rosin core solder. Use a 300-watt iron.

5. Check for continuity and grounds in the assembled coils.

6. Position the solenoid coil ground terminal over the nearest ground screw hole.

7. Position the ground brushes to the starter frame and install the retaining screws (Fig. 6).

8. Position the starter brush end plate to the frame, with the end plate boss in the frame slot.

9. Apply a thin coating of Lubriplate 777 on the armature shaft splines. Install the starter motor drive gear assembly to the armature shaft and install a new retaining stop ring. Install the stop ring retainer.

10. Position the fiber thrust washer on the commutator end of the armature shaft and position the armature in the starter frame.

11. Position the starter drive gear actuating lever to the frame and starter drive assembly, and install the pivot pin.

12. Position the starter drive actuating lever return spring and the drive gear housing to the frame. Install and tighten the through bolts to specification. **Do not pinch the brush leads between the brush plate and the frame.** Be sure that the stop ring retainer is seated properly in the drive gear housing.

13. Install the brushes in the brush holders. **Be sure to center the brush springs on the brushes.**

14. Position the drive gear actuating lever cover on the starter and install the brush cover band with a gasket. Tighten the band retaining screw.

15. Check the starter no-load amperage draw.

PART 14-3 SPECIFICATIONS

Vendor	Current Draw Under Normal Load (Amperes)	Normal Engine Cranking Speed (rpm)	Minimum Stall Torque @ 5 Volts (Foot Pounds)	Maximum Load (Amperes)	No-Load (Amperes)	Brushes Mfg. Length (Inches)	Brushes Wear Limit (Inches)	Brushes Brush Spring Tension (Ounces)
Ford Positive Engagement 4½-Inch Diameter	250	250-290	15.5	670	70	0.5	0.25	40
Ford Positive Engagement—4-Inch Diameter High Torque	—	—	9.6	500	70	0.46	0.25	45
Ford Positive Engagement—4-Inch Diameter	100-150	250-290	8	450	70	0.46	0.25	45

Maximum commutator runout in inches is 0.005.
Maximum starting circuit voltage drop (battery + terminal to starter terminal @ normal engine temperature) 0.5 volt.

LIGHTING SYSTEM, HORNS AND INSTRUMENTS

GROUP 15

PART 15-1 GENERAL LIGHTING SYSTEM, HORNS AND INSTRUMENTS SERVICE

1 DIAGNOSIS AND TESTING

LIGHT TROUBLE DIAGNOSIS GUIDE

ALL HEADLIGHTS DO NOT LIGHT	**1.** Loose battery cable. **2.** Loose quick disconnect or broken wire from the battery to the headlight switch. **3.** Defective headlight switch. **4.** Disconnected or broken wire from the headlight switch to the beam selector switch. **5.** Loose or broken wire to the bulbs. **6.** Defective beam selector switch. **7.** All headlight bulbs burned out. This may be caused by a defective or improperly adjusted generator voltage regulator (Group 13).
INDIVIDUAL LIGHTS DO NOT LIGHT	**1.** Burned out bulb. **2.** Loose or broken wires to the bulb. **3.** Poor ground.
LIGHTS BURN OUT REPEATEDLY	**1.** Loose or corroded electrical connections. **2.** Excessive vibration. **3.** Improperly adjusted or defective generator voltage regulator (Group 13).

INSTRUMENT TROUBLE DIAGNOSIS GUIDE

OIL PRESSURE INDICATOR LIGHT INOPERATIVE—FALCON	**1.** Indicator bulb burned out. **2.** Loose or broken wire from the light to the indicator switch. **3.** Defective oil pressure sender unit. (page 15-4).

CONTINUED ON NEXT PAGE

INSTRUMENT TROUBLE DIAGNOSIS GUIDE (Continued)

CHARGE INDICATOR LIGHT INOPERATIVE—FALCON	1. Burned out bulb. 2. Loose or broken wires to the armature terminal of the voltage regulator, or to the accessory terminal of the ignition switch.	3. Generator armature not grounded. 4. Generator regulator malfunction.
OIL PRESSURE INDICATOR GAUGE INOPERATIVE—COMET	1. Loose or broken wire from the constant voltage regulator to the oil pressure gauge. 2. Grounded or broken wire from	the engine oil pressure sending unit. 3. Defective gauge. 4. Defective oil pressure sending unit.
AMMETER GAUGE INOPERATIVE—COMET	1. Defective gauge (page 15-4). 2. Loose or broken wires.	3. Generating system malfunction.
FUEL GAUGE ERRATIC OR INOPERATIVE	1. Loose or broken wire from the constant voltage regulator to the fuel gauge. 2. Defective fuel gauge. 3. Loose, broken, or shorted wire from fuel gauge to the fuel tank sending unit.	4. Defective constant voltage regulator. 5. Defective fuel tank sending unit. 6. Poor ground between fuel tank and body.
TEMPERATURE GAUGE ERRATIC OR INOPERATIVE	1. Loose or broken wire from constant voltage regulator to the temperature gauge. 2. Defective temperature gauge. 3. Loose or broken wire from	the temperature sending unit to the temperature gauge. 4. Defective temperature sending unit. 5. Defective constant voltage regulator.
FUEL, TEMPERATURE, AND OIL PRESSURE GAUGES ERRATIC	1. Loose or corroded constant voltage regulator ground. 2. Defective constant voltage regulator.	3. Broken or loose wire from or to the constant voltage regulator. 4. Defective ignition switch.

HORN TROUBLE DIAGNOSIS GUIDE

HORNS DO NOT SOUND	1. Loose connections at horn button contact. 2. Open wire (blue-yellow stripe) from horn relay to horn button. 3. Open wire (yellow) from battery to horn relay.	4. Inoperative relay. 5. Horns defective or out of adjustment. 6. Open wire (yellow-green stripe) from horn relay to high- or low-pitch horn.
ONE HORN FAILS TO OPERATE	1. Broken or loose wire to the horn.	2. Horn defective or out of adjustment.
HORNS OPERATE CONTINUOUSLY	1. Shorted wire to horn button (blue-yellow stripe).	2. Shorted relay.

TURN INDICATOR TROUBLE DIAGNOSIS GUIDE

TURN INDICATOR LIGHTS INOPERATIVE	1. Burned out fuse. 2. Loose or broken wire from ignition switch to flasher. 3. Defective flasher. 4. Loose or broken wire from flasher to turn indicator switch.	5. Defective turn indicator switch. 6. Broken, shorted, or loose wires from switch to lights. 7. Burned out bulbs, or loose sockets.

CONTINUED ON NEXT PAGE

TURN INDICATOR TROUBLE DIAGNOSIS GUIDE (Continued)

TURN INDICATOR LIGHTS OPERATE INCORRECTLY	**1.** Loose, broken, or shorted wires from switch to light. **2.** Defective indicator switch.	**3.** Defective flasher. **4.** Burned out bulb.
TURN INDICATOR CANCELS IMPROPERLY	**1.** Cam improperly positioned on steering wheel hub.	**2.** Coil spring on switch plate assembly loose or weak.

WINDSHIELD WIPER MOTOR TROUBLE DIAGNOSIS GUIDE

WIPERS OPERATE INCORRECTLY	When checking an inoperative or sluggish windshield wiper, first examine the linkage under the instrument panel for obstructions. Disconnect the linkage from the motor and check for ease of operation, with the arms and blades removed. Disconnect the wiring harness connector plug from the motor, turn the wiper switch and ignition switch to the on position and check for voltage at the center opening of the plug (Fig. 1). No voltage indicates a defective circuit breaker, switch or wiring. With the switch at the off position, check for voltage between the two outside openings of the plug. If there is no voltage, replace the defective parts.

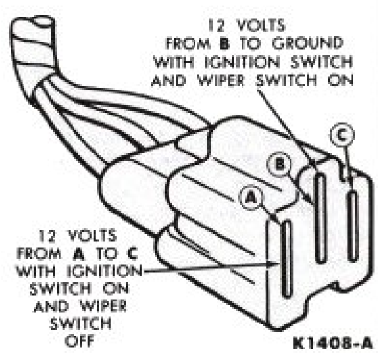


FIG. 1—Windshield Wiper Connector Plug Test Points

TESTING

HORN TEST

The only test necessary on the horns is for current draw. The current adjustment also adjusts the tone of the horn.

Current Draw Test. Connect a voltmeter and ammeter to the horn and to a voltage supply as shown in Fig. 2. The normal current draw for the horns at 12 volts is 9.0-10.0 amperes.

Always connect the battery positive lead to the horn terminal as shown in Fig. 2. If this is not done, damage may result to the horn.

HEADLIGHT SWITCH AND BEAM SELECTOR SWITCH TESTS

The following tests may be made to determine whether a headlight switch or a beam selector switch is defective:

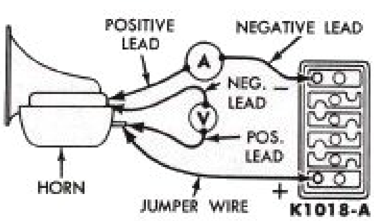


FIG. 2—Horn Current Draw Test

Turn on the headlights, and operate the beam selector switch. If none of the headlights turn on when the beam selector switch is operated, yet the instrument panel lights operate, the headlight switch or the red-yellow stripe wire from the headlight switch to the beam control switch is probably defective. Substitute a known good switch for the suspected switch to determine whether the switch or the wiring is at fault.

If the headlights operate only with the beam selector switch in one position, the selector switch or the wiring from the switch to the headlight is defective. Substitute a known good selector switch for the suspected switch to determine whether the switch or the wiring is at fault.

CONSTANT VOLTAGE REGULATOR TEST

Turn the ignition switch on, Check for voltage at the gauge feed wire (black with green stripe) at one of the gauges. The voltage should oscillate between zero and about 10 volts. If it does not, the constant voltage regulator is defective, or there is a short to ground between the voltage regulator and the gauges.

If the gauge unit is inaccurate or does not indicate, replace it with a new unit. If the gauge unit still is erratic in its operation, the sending unit or wiring to the sending unit is faulty.

If both the fuel gauge and the temperature gauge indicate improperly and in the same direction, the constant voltage regulator could be defective, as it supplies both gauges.

FUEL GAUGE AND FUEL LEVEL SENDING UNIT TEST

Disconnect the wire from the fuel level sending unit and connect it to a known good sending unit. Connect a jumper wire from the sending unit mounting plate to the car frame. Raise the float arm to the upper stop, the instrument panel gauge should read full. Lower the float arm to the bottom stop, the gauge should read empty.

If the gauge reads properly, the sending unit in the gas tank is defective.

If the gauge unit still indicates improperly or is erratic in its operation, the gauge unit or the wiring to the gauge unit is faulty. Repair the wire or replace the gauge unit.

grounds with a test light. Replace the armature if it is grounded.

6. Inspect the brush plate assembly for cracks or distortion. The brush holders should be securely fastened to the brush plate. Inspect the contact points for burned or pitted surfaces. Replace defective parts.

7. Inspect the motor housing and magnet assembly. Replace the assembly if it has a cracked magnet, or if the thrust button is hollowed out to a diameter greater than $\frac{1}{32}$ inch.

8. Replace the brushes if they are worn to $\frac{5}{16}$ inch. Replace distorted or burned brush springs.

TWO-SPEED WIPER MOTOR

1. Clean the gear housing of all old grease. **Do not allow any cleaning fluid to contact the armature shaft and output shaft bearings.**

2. Wipe all other parts with a clean cloth.

3. Inspect the gear housing for cracks or distortion. Replace a cracked or distorted housing.

4. Check all shafts, bushings, and gears for scored surfaces. Replace defective parts.

PART 15-2 LIGHTING SYSTEM AND HORNS

1 DESCRIPTION AND OPERATION

HEADLIGHTS

The Falcon uses two No. 2 type sealed-beam headlights. Each light has low-beam and high-beam filements.

The Comet uses four sealed-beam headlights. The two outboard lights each have low-beam and high-beam filaments and are marked by a numeral 2 molded in the glass lens. Locating tabs molded in the glass allow the mounting of the 2 lights in the outboard headlight support frames only. The low beams are used for No. 2 headlight alignment.

The inboard headlights, with a numeral 1 molded in the glass lens, have only one filament and are used with the high beams of the No. 2 headlights. Locating tabs molded in the glass allow the mounting of the No. 1 lights in the inboard headlight support frames only.

Both cars have a conventional beam selector switch located on the floorboard at the left.

Quick disconnect terminals are also provided at the left and right of the radiator support assembly. The terminals are color coded. Like colored terminals are connected together. The green wire with a black stripe supplies current to the headlight high beams. The red wire with a black stripe supplies the low-beam filaments. The black wire with a yellow stripe supplies the parking lights (Fig. 1 or 2).

HORNS

The Falcon and Comet are equipped with a pair of tuned horns controlled by a relay. The horn button closes the relay contacts completing the circuit to the horns. One of the horns has a high-pitched tone; the other has a low-pitched tone.

2 IN-CAR ADJUSTMENTS AND REPAIRS

HEADLIGHT ALIGNMENT

All headlight adjustments should be made with a half-full fuel tank plus or minus one gallon, with a person seated in the driver's seat, the car unloaded and the trunk empty except for the spare tire and jacking equipment, and recommended pressure in all tires. Before each adjustment, bounce the car by pushing on the center of both the front and rear bumpers, to level the car.

To align the No. 1 headlights (inboard lights) by means of a wall screen, select a level portion of the shop floor. Lay out the floor and wall as shown in Fig.3.

Establish the headlight horizontal centerline by subtracting 20 inches from the actual measured height of the headlight lens center from the floor and adding this dimension (dimension "B," upper diagram Fig.4) to the 20-inch reference line obtained by sighting over the uprights. Draw a horizontal line 2 inches below, and parallel to the headlight horizontal centerline. Then draw the headlight vertical centerlines on the screen as measured on the car (dimension "A," upper diagram Fig. 4).

NO. 1 HEADLIGHT ADJUSTMENT (INNER LIGHTS —COMET ONLY)

Adjust each No. 1 headlight (inner light) beam as shown in Fig. 4. **Cover the No. 2 lights when making this adjustment.**

NO. 2 HEADLIGHT ADJUSTMENT (OUTER LIGHTS)

To align the No. 2 headlights (outer lights), a different wall chart (lower diagram Fig. 4) is used. Dimension "B" for the No. 2 lights is the same as "B" for the No. 1 lights, dimension "A" is as measured on the car. **Note that the line of adjustment of the No. 2 lights is the horizontal centerline of the No. 2 lights.** Turn the headlights to low beam and adjust each No. 2 light as shown in Fig. 4.

Each headlight can be adjusted by means of two screws located under the headlight trim ring as shown in Fig. 5. Always bring each beam into final position by turning the adjusting screws clockwise so that the headlights will be held against the tension springs when the operation is completed.

Some states may not approve of the 2-inch dimension for the No. 1 headlights. Check the applicable state law, as a 3-inch dimension may be required.

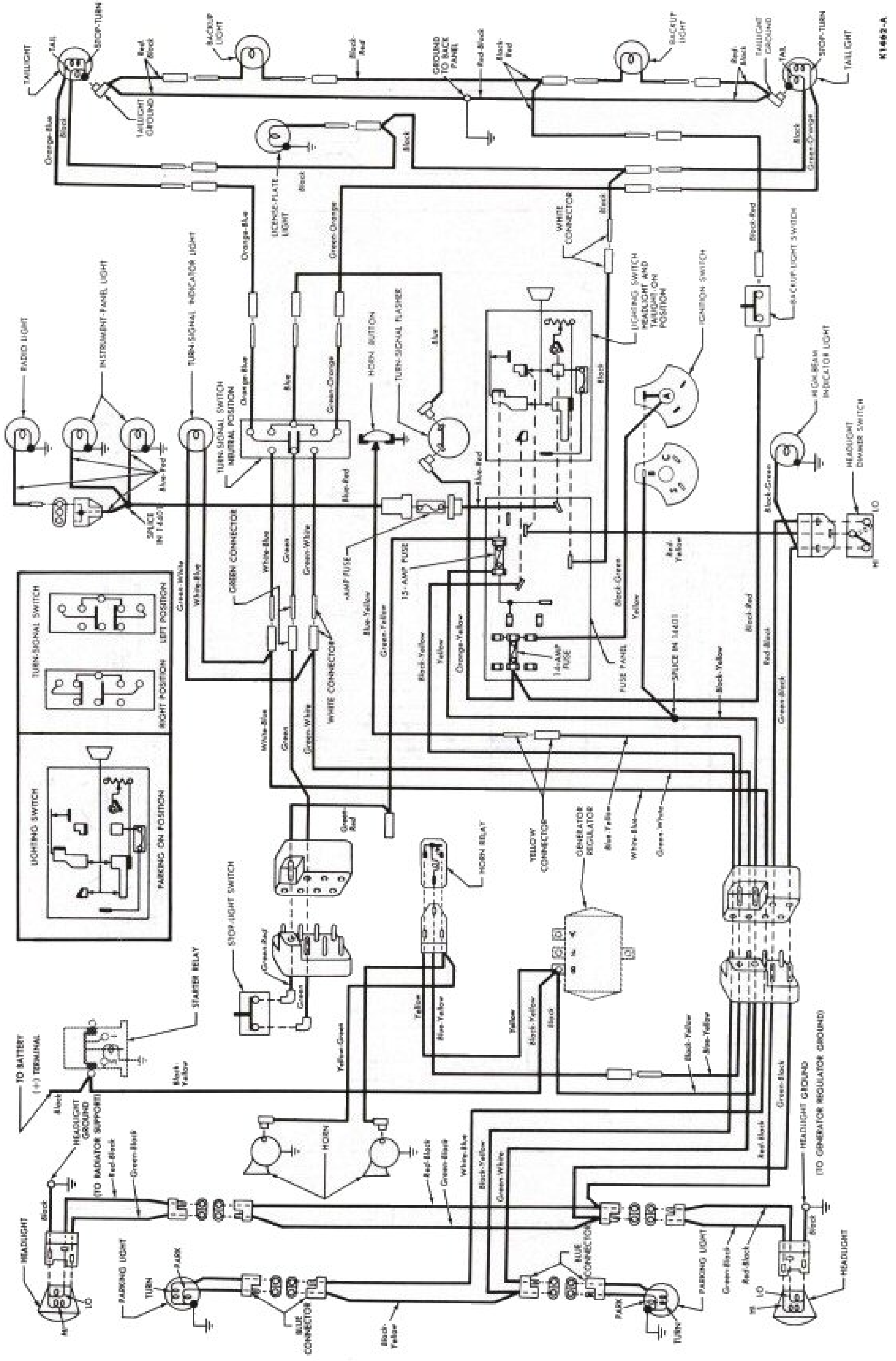


FIG. 1—Exterior Lighting, Horns and Turn Signals Schematic—Falcon

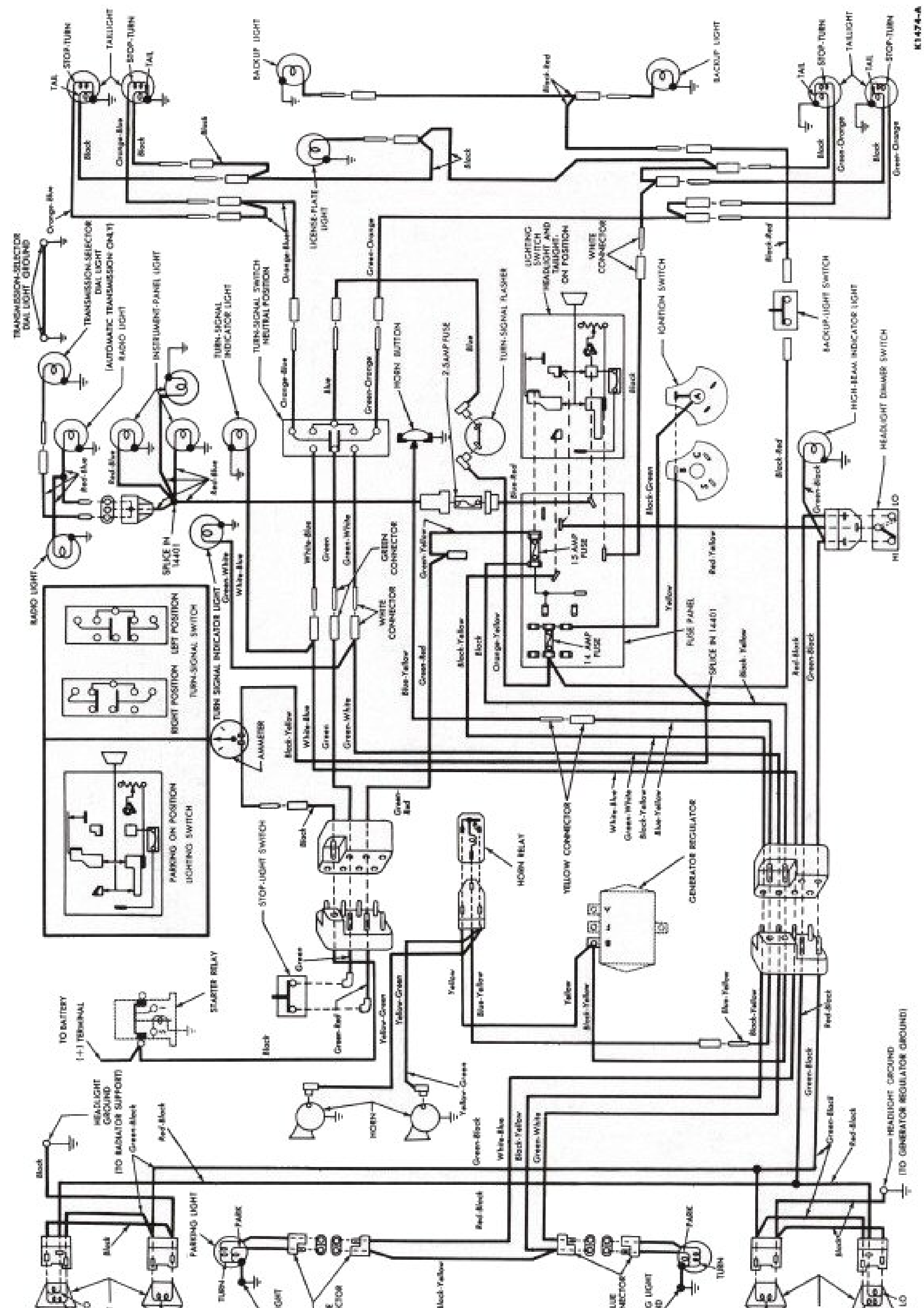


FIG. 2—Exterior Lighting, Horns and Turn Signals Schematic—Comet

3 REMOVAL AND INSTALLATION

HEADLIGHTS

1. Remove the retaining screws and the headlight trim ring.

2. Loosen the bulb retaining ring screws (Fig. 5), rotate the retaining ring counterclockwise and remove it.

3. The headlight bulb may now be pulled forward far enough to disconnect the wiring assembly plug.

4. Plug in the new bulb and place it in position, make sure that the locating tabs are placed in the positioning slots.

5. Install the headlight bulb retaining ring, rotate it clockwise under the screws and tighten the screws.

6. Position the headlight trim ring and install the retaining screws.

PARKING LIGHT

The parking light is shown in Fig. 6. To replace the bulb, remove the lens retaining screws and the lens.

TAIL AND STOP LIGHT AND BACK-UP LIGHT—FALCON

The Falcon tail and stop light, and back-up lights are shown in Fig. 7. To replace the tail and stop light bulb, remove the retaining screws and the lens. To replace the back-up light bulb, remove the retaining screws and the lens and remove the back-up light assembly from the lens socket.

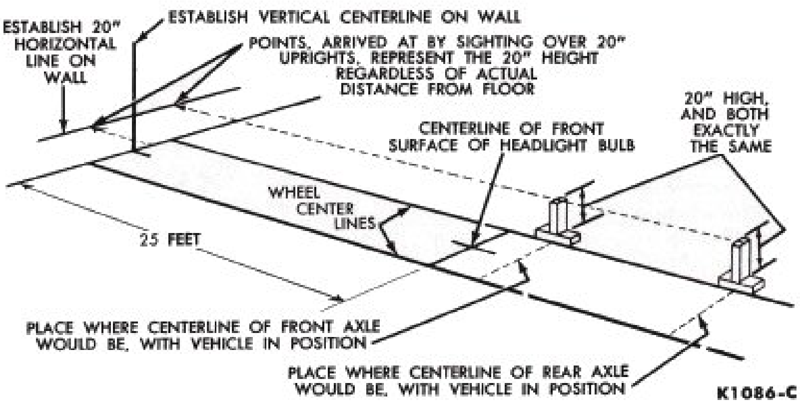


FIG. 3—Floor and Wall Layout

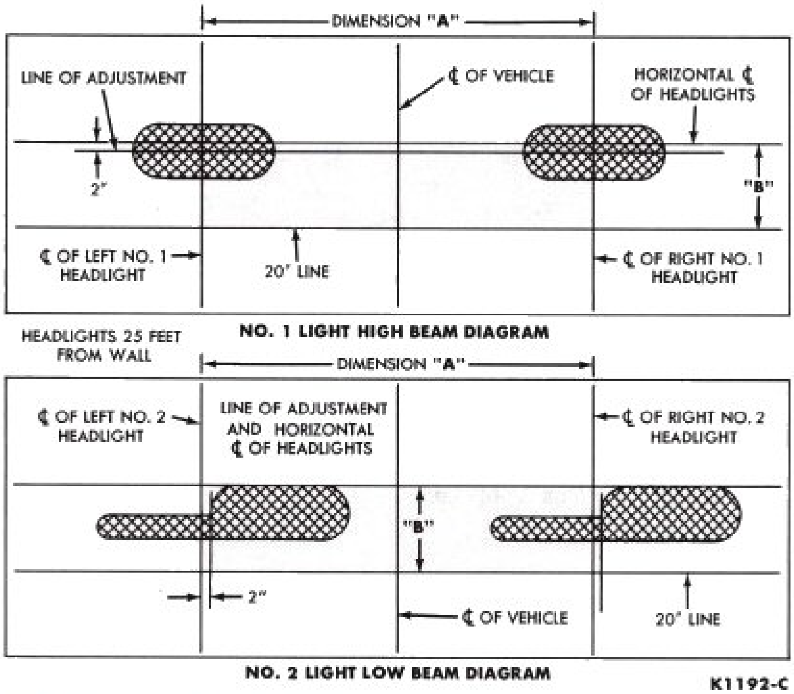


FIG. 4—Headlight Wall Screens

TAIL AND STOP LIGHT AND BACK-UP LIGHT—COMET

The tail and stop light and back-up light are shown in Fig.8. To replace the bulbs, remove the retaining screws and the lens.

LICENSE PLATE LIGHT

To replace the bulb, remove the bezel retaining screw, bezel, and lens.

DOME LIGHT

Remove the two screws retaining the dome light lens. Remove the lens and then replace the bulb.

INSTRUMENT LIGHTS

The instrument panel light bulbs can be replaced by pulling out the individual light sockets from the rear of the instrument panel (Fig. 9 or 10).

HORNS

The horns are mounted on each side of the engine compartment directly behind the radiator support. Disconnect the horn wire from the terminal. Remove the horn mounting bracket to horn retaining screws and remove the horn.

To install, mount the horn in position, then connect the horn wire to the horn terminal.

HORN RING

The horn ring is assembled to the steering wheel. The horn ring contact makes connection with the horn relay wire by means of a sliding contact mounted on the end of the steering column. When the horn ring is depressed, the horn ring contact makes connection with ground.

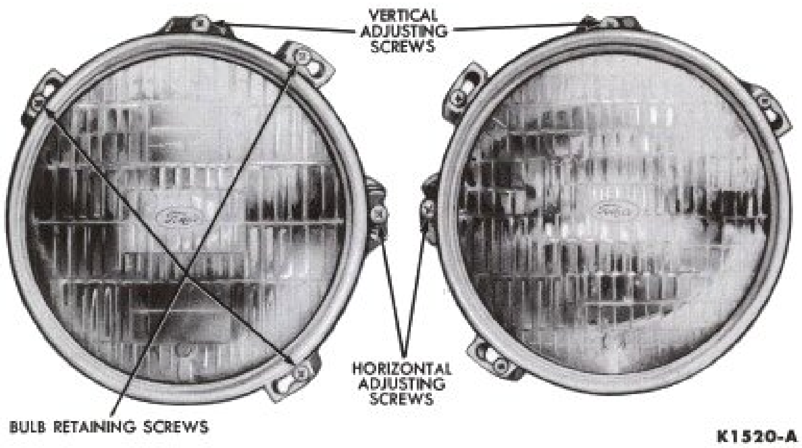


FIG. 5—Headlight Adjustment

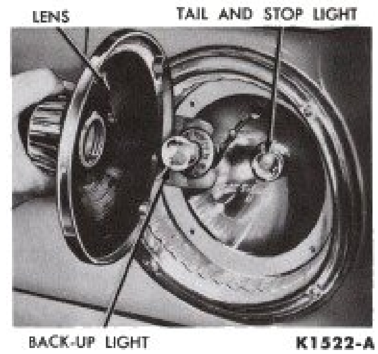


FIG. 7—Tail and Stop Light—Falcon

HORN RELAY

The horn relay is mounted to the left-hand radiator support. Remove the cable connector at the relay. Remove the one mounting screw, and remove the relay.

HORN BUTTON CONTACT

REMOVAL

1. Disconnect the horn wire under the instrument panel, to the left of the steering column.

2. Press down evenly on the horn button or ring and turn counterclockwise until it lifts out from the steering wheel.

3. Remove the horn button and spring.

4. Mark the steering wheel position to the steering column. Remove the steering wheel retaining nut and remove the steering wheel.

5. Remove the turn indicator lever, remove the turn indicator mechanism retaining screws and lift the mechanism to one side.

6. Remove the screw retaining the horn button contact and pull the contact and wire from the steering column.

INSTALLATION

1. Install the horn contact wire through the steering column and install the retaining screw.

2. Position the turn indicator mechanism and install the retaining screws.

3. Install the turn indicator lever.

4. Install the steering wheel and retaining nut.

5. Install the horn button spring and button.

6. Connect the horn wire under the instrument panel.

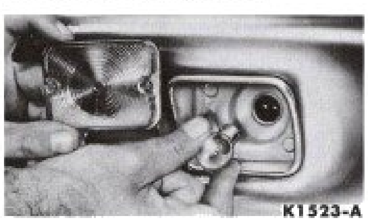


FIG. 6—Parking Light—Typical

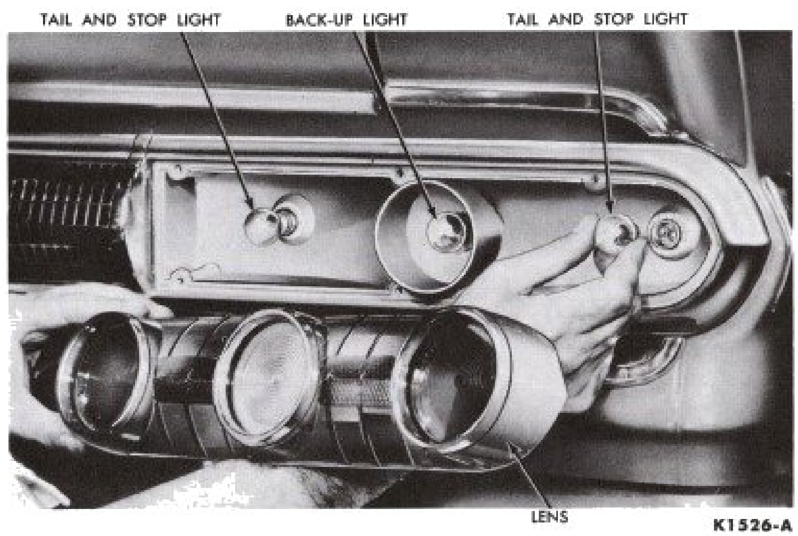


FIG. 8—Tail and Stop Light—Comet

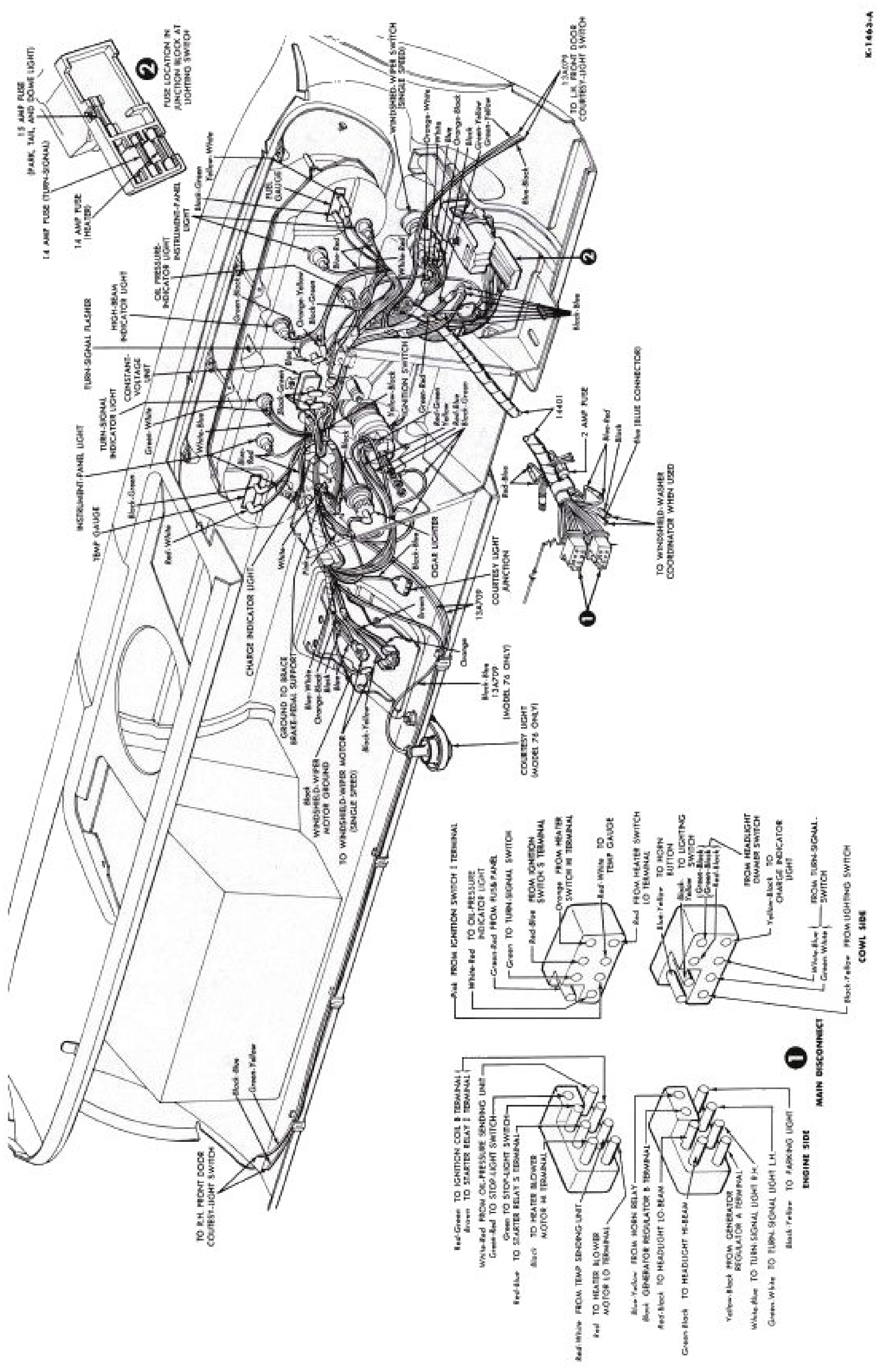


FIG. 9—Instrument Panel Lights—Falcon

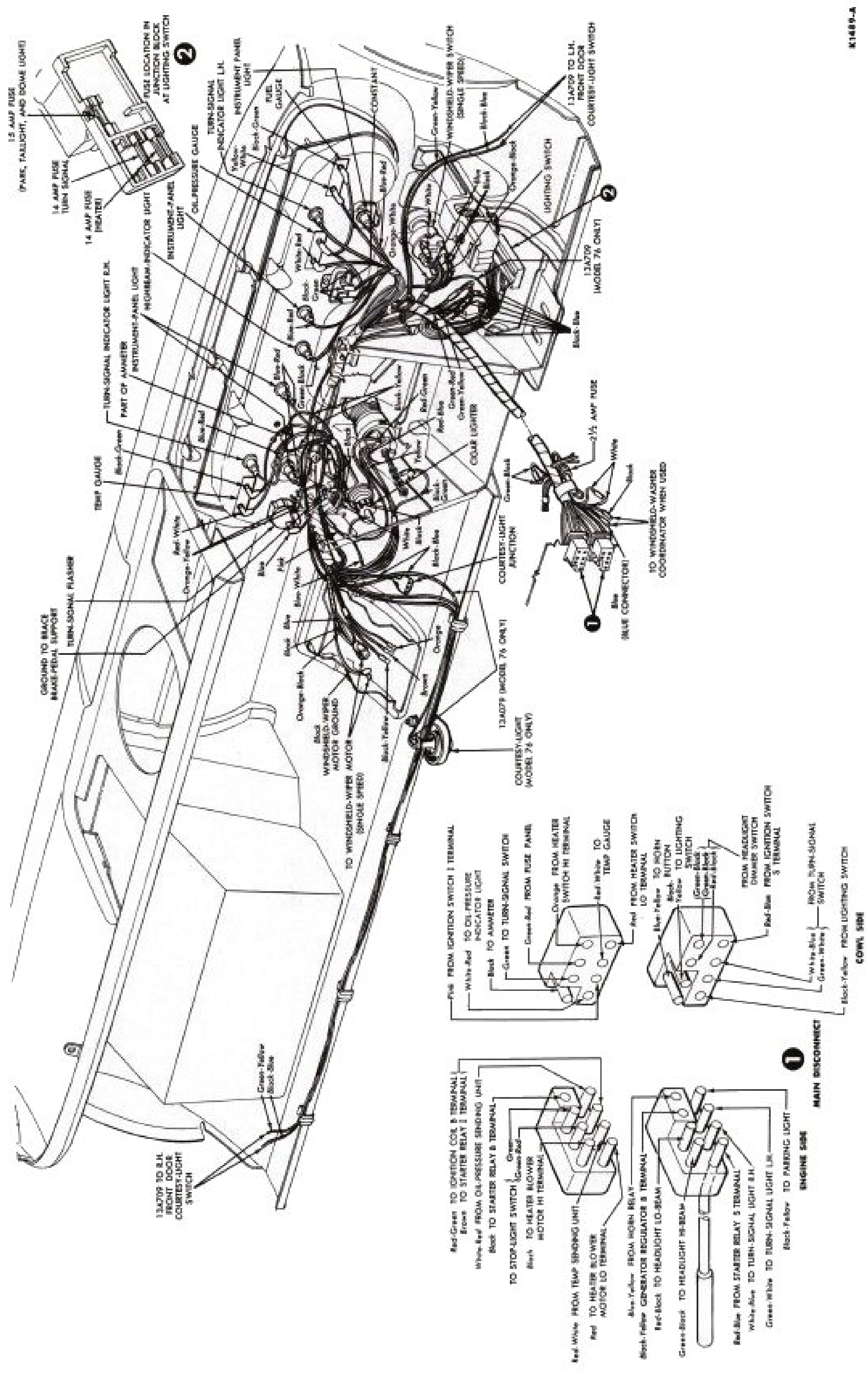


FIG. 10—Instrument Panel Lights—Comet

PART 15-3 SWITCHES, CIRCUIT BREAKERS, AND FUSES

Section	Page	Section	Page

1 DESCRIPTION AND OPERATION

HEADLIGHT SWITCH

A combination headlight switch, dome light switch, and circuit breaker is used (Fig. 1). The circuit breaker protects the headlight circuit.

The fuse panel mounted under the headlight switch contains the following fuses: parking, rear, dome, and instrument lights, radio, turn indicator, and back-up lights, and heater.

Before removing any switch, disconnect the battery ground cable from the battery.

2 REMOVAL AND INSTALLATION

HEADLIGHT SWITCH

1. Remove the control knob and shaft by pressing the knob release button on the switch housing (Fig. 1), with the knob in the full ON position. Pull the knob out of the switch.

2. Unscrew the mounting nut, remove the switch, remove the retaining clip, and remove the fuse panel from the switch.

3. To install the switch, connect the fuse panel to the headlight switch, install the retaining clip, insert the switch in the instrument panel, and install the mounting nut.

4. Install the knob and shaft assembly by inserting it all the way into the switch until a distinct click is heard. In some instances it may be necessary to rotate the shaft slightly until it engages the switch-contact carrier.

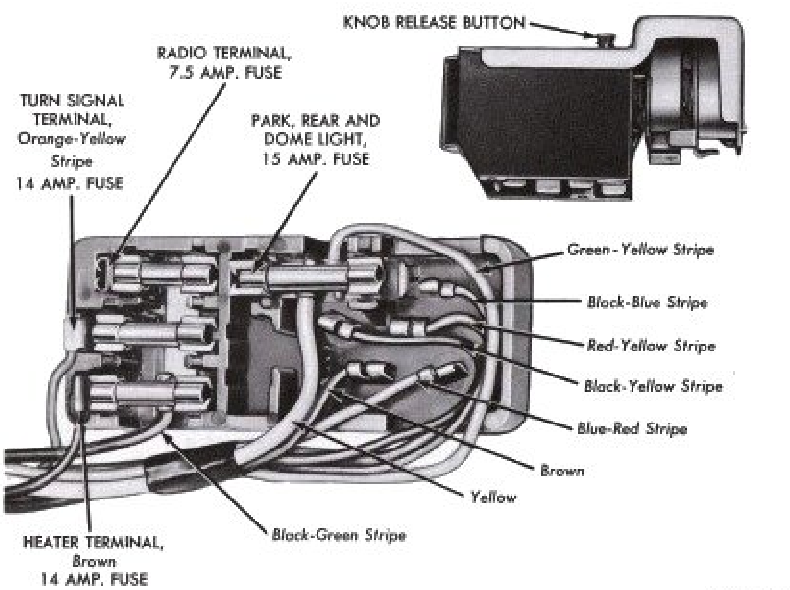


FIG. 1—Headlight Switch

HEADLIGHT BEAM SELECTOR SWITCH

Lay the floor mat back from the area of the switch, and remove the mounting screws (Fig. 2). Disconnect the wire terminal block from the switch.

To install the switch, connect the terminal block to the switch and install the switch to the floor. Replace the floor mat.

STOP LIGHT SWITCH

Disconnect the wires at the bullet connectors, and unscrew the switch

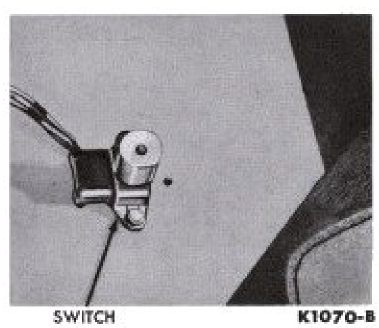


FIG. 2—Headlight Beam Selector Switch

from the brake master cylinder (Fig. 3).

DOME LIGHT SWITCH

The dome light switch is part of the headilght switch. It is actuated by rotating the switch control knob to the maximum counterclockwise position. The dome light and headlight switch is replaced as a unit (Fig. 1).

IGNITION SWITCH AND LOCK CYLINDER

1. Disconnect the negative cable from the battery.

2. Turn the ignition key to the accessory position. Slightly depress the pin shown in Fig. 4, turn the key counterclockwise, and pull the key and lock cylinder out of the switch assembly. If only the lock cylinder is to be replaced, proceed to Step 9.

3. Press in on the rear of the switch and rotate the switch ⅛ turn counterclockwise (as viewed from the terminal end). Remove the bezel, switch, and spacer.

4. Remove the nut from the back of the ignition switch. Remove the accessory and gauge feed wires from the accessory terminal of the switch. Pull the insulated plug from the rear of the switch.

5. If a new ignition switch is to be installed, insert a screwdriver into the lock opening of the ignition switch and turn the slot in the switch to a full counter clockwise position.

6. Connect the insulated plug with wires to the back of the ignition switch. Position the acessory and gauge wires on the ignition switch stud and install the retaining nut.

7. Position the spacer on the switch with the open face away from the switch.

8. Place the bezel, switch, and spacer in the switch opening, press the switch toward the instrument panel and rotate it ⅛ turn to lock it in position.

9. If a new lock cylinder is to be installed, insert the key in the cylinder and turn the key to the accessory position. Place the lock and key in the ignition switch, depress the pin slightly (Fig. 4) and turn the key counterclockwise. Push the lock cylinder into the switch. Turn the key to check the lock cylinder operation.

10. Connect the battery cable and check the ignition switch.

WINDSHIELD WIPER SWITCH

1. Disconnect the battery cable.

2. Remove the wiper switch knob, bezel nut, and bezel.

3. Pull out the switch from under the instrument panel. Disconnect the plug connector from the switch and remove the switch.

4. Position the switch and connect the plug connector.

5. Position the switch in the instrument panel and install the bezel, bezel nut, and knob.

6. Connect the battery cable and check the operation of the switch.

FIG. 3—Typical Stop Light Switch

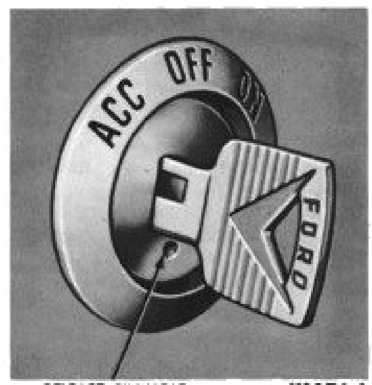


FIG. 4—Typical Ignition Switch Removal

PART 15-4 INSTRUMENTS

1 DESCRIPTION AND OPERATION

All of the instruments are electrically operated except the speedometer. Brightness of the instrument panel lights is controlled by a rheostat on the lighting switch. Front views of both instrument panels are shown in Figs. 1 and 2.

GAUGES

The gauges and lights are shown in Figs. 9 and 10 Part 15-2. Figs. 3 and 4 show the gauge circuits. The instrument cluster for the Falcon includes a fuel gauge, temperature gauge, charge indicator light, oil pressure indicator light, speedometer, high-beam indicator light, and a left and right-hand turn signal indicator lights.

The instrument cluster for the Comet includes the same components except that an oil pressure indicator gauge and a charge indicator gauge are used instead of indicator lights.

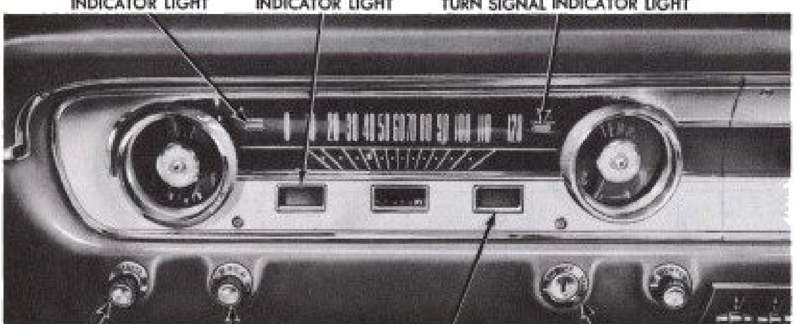


FIG. 1—Instrument Panel—Falcon

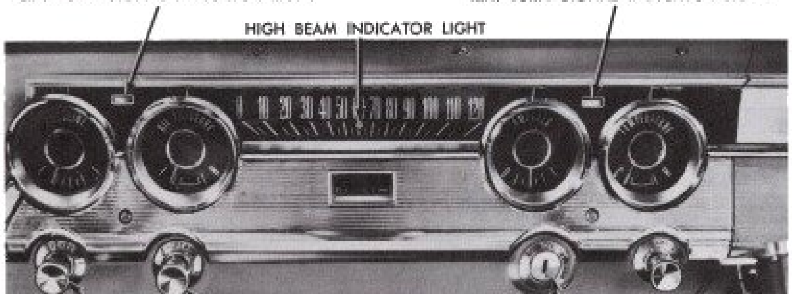


FIG. 2—Instrument Panel—Comet

There are also separate left-and-right-hand turn signal indicator lights.

A constant voltage regulator (Fig. 5), maintains a constant voltage supply to the fuel gauge and temperature gauge circuits on the Falcon and to the fuel gauge, temperature gauge, and oil pressure gauge circuits in the Comet.

The constant voltage regulator maintains an average value of 5.0 volts at the gauge terminals. The regulator is temperature compensated for all expected ambient (surrounding air) temperatures.

FUEL GAUGE

The fuel gauge consists of a sending unit, located on the gas tank, and a remote register unit (fuel gauge) mounted in the instrument cluster. The remote register unit pointer is controlled by a bimetallic arm and heating coil. The sending unit is a rheostat that varies its resistance depending on the amount of fuel in the tank. The fuel gauge circuit is shown in Fig. 3 or 4.

TEMPERATURE GAUGE

The temperature gauge consists of a sending unit mounted in the cylinder head at the top front on the V-8 (Fig. 6 or 7), left rear on the six, and a remote register unit, (temperature gauge) mounted in the instrument cluster. The principle of operation is similar to the fuel gauge except that the resistance of the sending unit is varied by engine temperature. The temperature gauge circuit is shown in Fig. 3 or 4.

OIL PRESSURE INDICATOR GAUGE—COMET

The meter-type oil pressure gauge consists of a sending unit on the en-

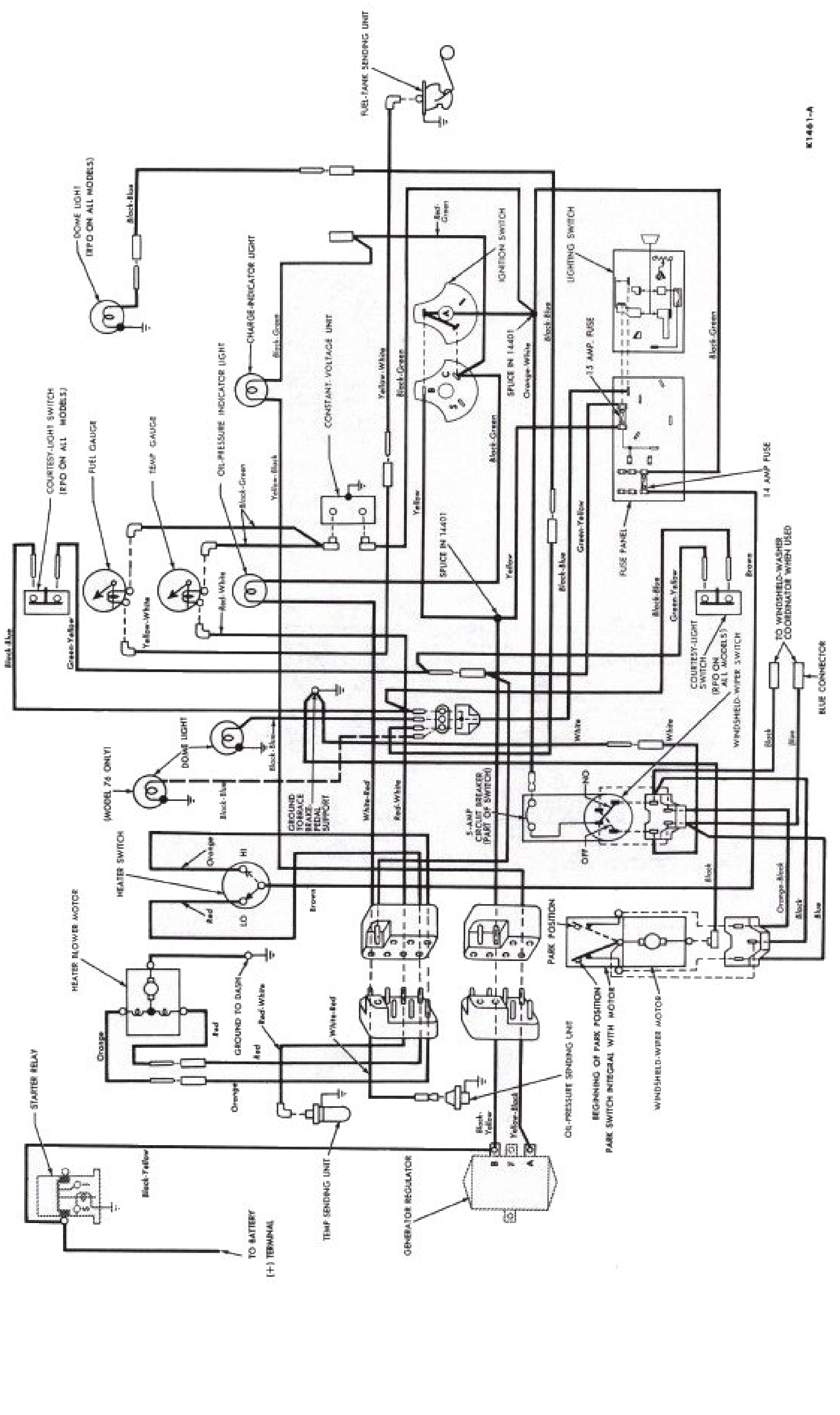


FIG. 3—Interior Lighting, Windshield Wiper, Gauges, and Heater Schematic—Falcon

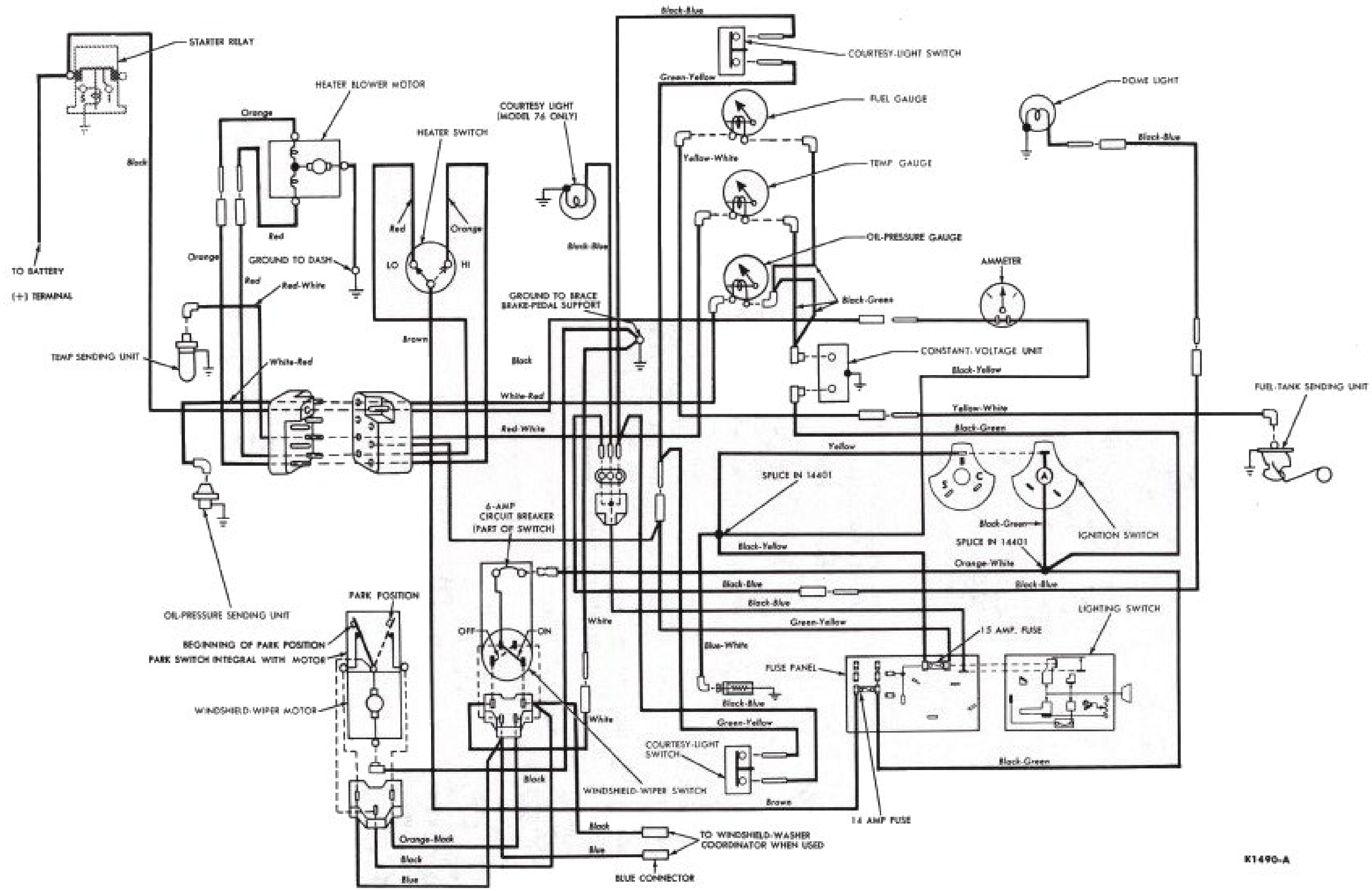


FIG. 4—Interior Lighting, Windshield Wiper, Gauges, and Heater Schematic—Comet

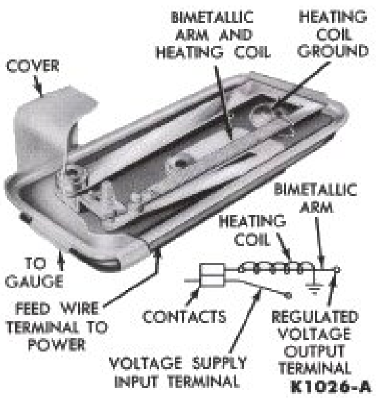


FIG. 5—Constant Voltage Regulator

gine above the oil filter on the V-8 (Fig. 7), at the left rear on the six, and a remote register unit in the instrument cluster. The Oil Pressure gauge circuit is shown in Fig. 4.

CHARGE INDICATOR LIGHT—FALCON

A red generator charge indicator light is used. This light flashes on if the battery is discharging and the generator is not supplying current. The indicator light is connected between the armature terminal of the generator regulator and the coil terminal of the ignition switch. This actually places the light in parallel with the regulator cut-out contacts. If the ignition switch is on, and the cutout contacts are open, the charge indicator light will light up, indicating that the generator is not connected to the battery. The circuit for the light is from the battery, through the light, and through the generator armature, to ground (Fig. 8). As soon as the generator comes up to speed, the cut-out contacts close. This by-passes the warning light which then goes out and thus indicates that the battery is connected to the generator.

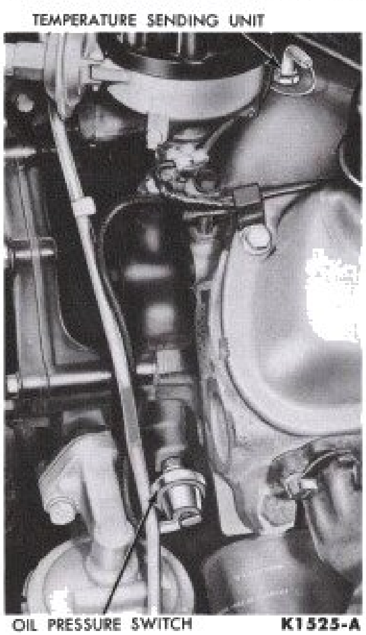


FIG. 6—Temperature Sender and Oil Pressure Switch—Falcon V-8

CHARGE INDICATOR GAUGE—COMET

The charge indicator is a magnetic-loop type ammeter.

OIL PRESSURE INDICATOR LIGHT—FALCON

A red indicator light flashes on when the oil pressure is below a safe value. The light should come on when the ignition switch is first turned on, and it should go out when the engine comes up to speed. The light is connected between the oil pressure switch unit mounted on the engine at the left rear on the six, above the oil filter on the V-8 (Fig. 6), and the coil terminal of the ignition switch.

TURN INDICATOR

Figs. 1 and 2 Part 15-2 show the turn indicator wiring diagrams.

SPEEDOMETER

The speedometer is connected to the output shaft of the transmission by means of a flexible shaft, and a drive gear located inside the transmission. The flexible shaft drives the speedometer which registers speed in miles per hour and also drives an odometer which records distance traveled in miles and tenths of a mile.

FIG. 7—Temperature and Oil Pressure Sender—Comet V-8

WINDSHIELD WIPER

A single-speed and a two-speed electric wiper motor are available. Figs. 3 and 4 show the single-speed electric wiper motor circuits. The two-speed electric wiper motor circuit is shown in Fig. 9.

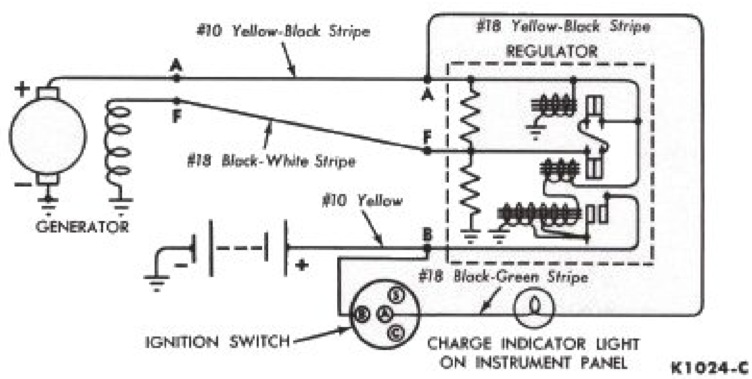


FIG. 8—Generator Charge Indicator Light Circuit—Falcon

K1493-A

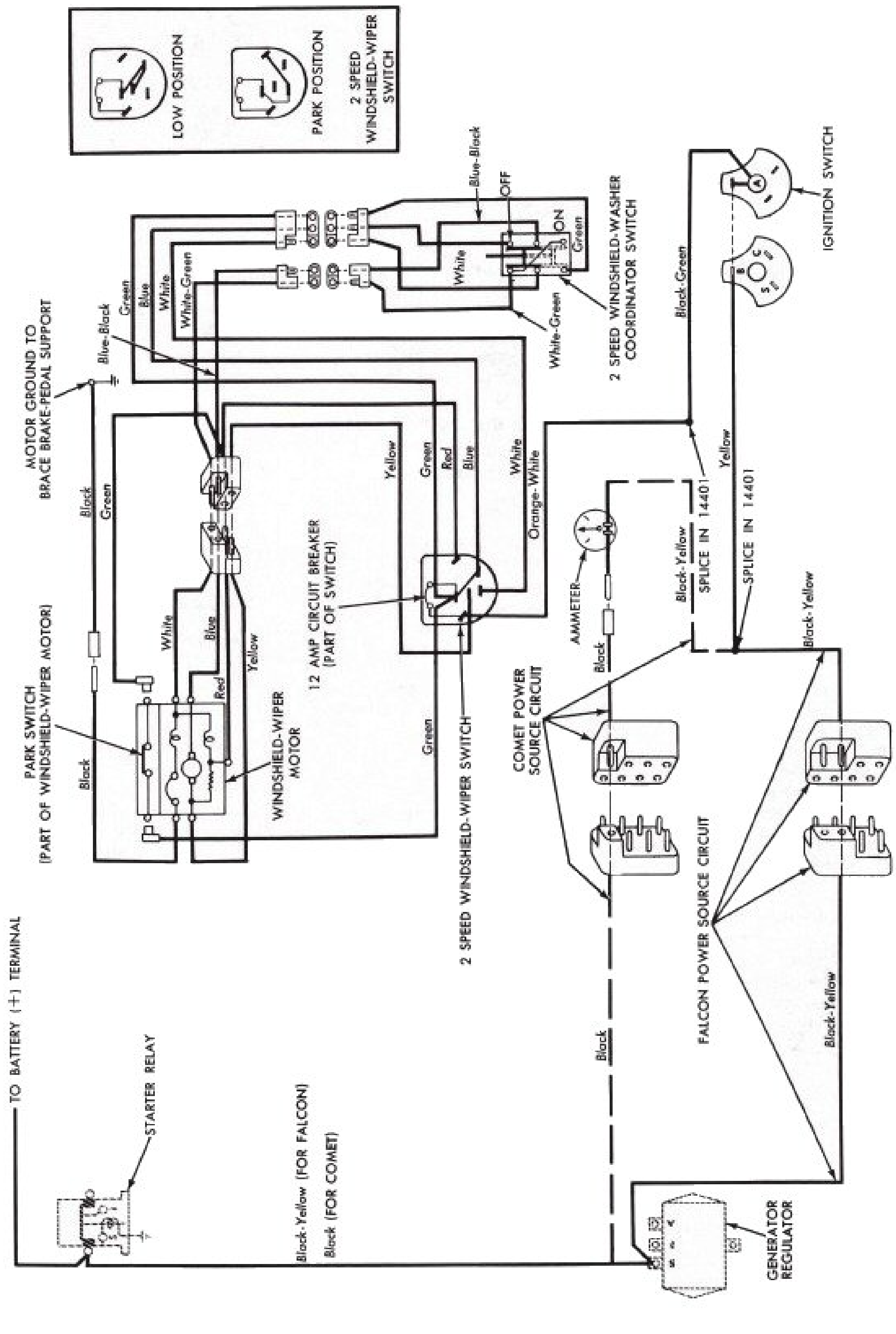


FIG. 9—Two-Speed Wiper Motor Circuit

2 IN-CAR ADJUSTMENTS AND REPAIRS

WINDSHIELD WIPER BLADE ADJUSTMENT

TWO-SPEED WIPER

Turn the ignition switch to the accessory position momentarily, with the wiper switch off. After bringing the pivot shafts to their park positions, install the wiper blades so that they lie flat against the lower edge of the windshield.

SINGLE-SPEED WIPER

The motor park position adjustment is made during assembly after overhaul. Follow the procedure outlined in the section covering assembly. To adjust the wiper blades, follow the procedure given for the 2-speed wiper.

3 REMOVAL AND INSTALLATION

INSTRUMENT CLUSTER

1. Disconnect the battery cable.
2. Disconnect the speedometer cable from the speedometer head.
3. Remove the six screws retaining the instrument cluster assembly to the instrument panel and tilt the cluster forward.
4. Disconnect the wiring and the bulb sockets and remove the cluster assembly.
5. Position the cluster and connect the wiring and the bulb sockets.
6. Install the instrument cluster assembly to the instrument panel with the six retaining screws.
7. Connect the speedometer cable and the battery cable.
8. Check the operation of all gauges, lights, and signals.

To replace the fuel gauge, temperature gauge, oil pressure gauge, charge indicator gauge, and speedometer, it is necessary to remove the instrument cluster assembly.

CONSTANT VOLTAGE REGULATOR

1. Remove the instrument cluster assembly from the instrument panel and tilt the cluster forward.
2. Disconnect the wires from the constant voltage regulator.
3. Remove the regulator retaining screw and remove the regulator.
4. Install the constant voltage regulator in place with the retaining screw.
5. Connect the wires to the regulator (Fig. 9 or 10 Part 15-2).
6. Install the instrument cluster assembly to the instrument panel and check the operation of the gauges.

FUEL GAUGE

1. Remove the instrument cluster assembly.
2. Remove the six screws retaining the instrument cluster back plate assembly, and remove the back plate assembly.
3. Remove the two screws retaining the fuel gauge to the back plate and remove the gauge.
4. Position the fuel gauge and install the two retaining screws.
5. Position the back plate assembly and install the six retaining screws.
6. Install the instrument cluster assembly in the instrument panel.

FUEL SENDING UNIT

1. Remove the fuel from the fuel tank.
2. Disconnect the fuel gauge sending unit wire from the sending unit.
3. Loosen the hose clamp and disconnect the tank line at the sending unit.
4. Remove any dirt that has accumulated around the sending unit so that it will not enter the tank.
5. Turn the sending unit retaining ring counterclockwise and remove the unit, retaining ring, and mounting gasket.
6. Clean the fuel gauge sending unit mounting surface at the fuel tank.
7. Position the sending unit and mounting gasket on the fuel tank and secure with the retaining ring.
8. Connect the sending unit wire and the fuel tank line.
9. Fill the tank with the fuel removed.
10. Check the fuel gauge operation and check for leaks.

TEMPERATURE GAUGE

1. Remove the instrument cluster assembly.
2. Remove the six screws retaining the instrument cluster back plate assembly and remove the back plate assembly.
3. Remove the two screws retaining the temperature gauge to the back plate and remove the gauge.
4. Position the temperature gauge and install the two retaining screws.
5. Position the back plate assembly and install the six retaining screws.
6. Install the instrument cluster assembly in the instrument panel.

TEMPERATURE SENDING UNIT

1. Disconnect the temperature sending unit wire from the sending unit.
2. Prepare the new temperature sending unit for installation by applying a small amount of conductive water resistant sealer C3AZ-19554-B, to the threads.
3. Remove the temperature sending unit from the cylinder head and immediately install the new temperature sending unit.
4. Connect the wire to the temperature sending unit.
5. Start the engine and check the sending unit operation.

OIL PRESSURE INDICATOR GAUGE—COMET

1. Remove the instrument cluster assembly.
2. Remove the six screws retaining the instrument cluster back plate assembly and remove the back plate assembly.
3. Remove the two screws retaining the Speedometer, the two screws retaining the Speedometer dial to the back plate, and remove the speedometer assembly.
4. Remove the two nuts retaining the oil pressure gauge and remove

the gauge.

5. Position the oil pressure gauge and install the two retaining nuts.

6. Position the speedometer assembly and install the two speedometer dial retaining screws and the two speedometer retaining screws.

7. Position the back plate assembly and install the six retaining screws.

8. Install the instrument cluster assembly to the instrument panel.

OIL PRESSURE SENDING UNIT OR OIL PRESSURE SWITCH

To replace the unit, disconnect the wire from the terminal. Remove the unit from the engine. Apply conductive sealer C3AZ-19554-B to the threads of the new unit and install the unit. Connect the wire to the terminal and check the operation of the unit.

CHARGE INDICATOR GAUGE—COMET

1. Remove the instrument cluster assembly.

2. Remove the six screws retaining the instrument cluster back plate assembly and remove the back plate assembly.

3. Remove the two screws retaining the speedometer, the two screws retaining the speedometer dial to the back plate and remove the speedometer assembly.

4. Remove the two nuts retaining the charge indicator gauge and remove the gauge.

5. Position the charge indicator gauge and install the two retaining nuts.

6. Position the speedometer assembly and install the two speedometer dial retaining screws and the two speedometer retaining screws.

7. Position the back plate assembly and install the six retaining screws.

8. Install the instrument cluster assembly to the instrument panel.

TURN INDICATOR SWITCH AND WIRE

REMOVAL

1. Disconnect the horn wire and turn indicator switch wires under the instrument panel at the steering column. Slide the plastic insulating tubing out of the steering column and off the wires.

2. Remove the horn button and spring.

3. Mark the steering wheel position on the steering column. Remove the steering wheel retaining nut and remove the steering wheel.

4. Unscrew and remove the turn indicator lever.

5. Remove the turn indicator switch to steering column retaining screws and pull the switch away from the steering column flange.

6. Remove the steering column flange retaining nuts. The bolts will fall into the steering column upper hub.

7. Remove the turn indicator switch, steering column flange, sleeve, and wiring assembly from the steering column.

8. Remove the two bolts that fell into the steering column upper hub.

9. Remove the steering column flange from the turn indicator switch assembly.

INSTALLATION

1. Route the turn indicator switch wiring through the hole in the steering column flange, down the steering column, and out the hole in the steering column under the instrument panel.

2. Position the steering column flange retaining bolts on the under side of the flange and start the retaining nuts. Position the steering column flange to the steering column.

3. Tighten the steering column flange to steering column retaining nuts.

4. Position the turn indicator switch on the steering column flange and install the retaining screws.

5. Install the turn indicator lever.

6. Position the steering column flange sleeve and sleeve spring.

7. Install the steering wheel and retaining nut.

8. Install the horn button and spring.

9. Slide the insulating tubing over the turn indicator and horn button wires and part way into the steering column. Connect the wires.

10. Check the turn indicator and horn operation.

TURN INDICATOR FLASHER

The turn indicator flasher is located behind the instrument cluster (Fig. 9 or 10 Part 15-2). Disconnect the wires from the flasher unit terminals and pull the flasher from its retaining clip.

SPEEDOMETER

1. Remove the instrument cluster assembly.

2. Remove the six screws retaining the instrument cluster back plate assembly and remove the back plate assembly.

3. Remove the two screws retaining the speedometer, the two screws retaining the speedometer dial to the back plate, and remove the speedometer assembly.

4. Position the speedometer and install the two speedometer dial retaining screws and the two speedometer retaining screws.

5. Position the back plate assembly and install the six retaining screws.

6. Install the instrument cluster assembly to the instrument panel.

SPEEDOMETER CABLE

To replace the speedometer drive cable, disconnect the cable housing from the speedometer, and pull the cable out of the housing. Wipe off all of the old lubricant. Lubricate the new cable with cable lubricant B5A-19581-A (do not over lubricate), insert it all the way into the housing, and twist it slightly to make sure that the squared drive is engaged in the speedometer driven gear. **If a speedometer cable is broken, it will be necessary to disconnect both ends of the cable housing in order to remove the broken sections. Tighten the mounting bolt to 20-25 foot-pounds torque (Fig. 10).**

The speedometer driven gear is held on to the speedometer cable housing by a retainer clip. When replacing the driven gear, make certain that the gear is secure by placing the gear in position before inserting the retainer clip through the gear slots.

WINDSHIELD WIPER MOTOR

1. Disconnect the harness connector from the wiper motor.

2. Remove the three bolts retaining the wiper motor and mounting bracket assembly to the dash panel. Lower the assembly and disconnect

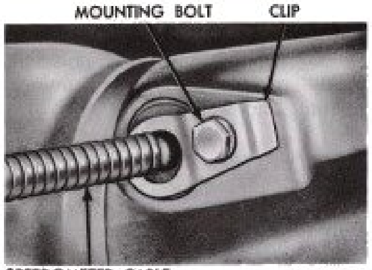


FIG. 10—Speedometer Cable Mounting

the wiper links at the motor. Remove the motor and bracket assembly.

3. Transfer the mounting bracket with grommets to the new motor.

4. Position the motor and bracket assembly and connect the wiper links to the motor.

5. Position the motor and bracket assembly to the dash panel and install the three retaining bolts.

6. Connect the harness connector to the wiper motor.

7. Connect the battery and check the operation of the wiper motor and the park position of the wiper blades.

WIPER PIVOT SHAFT AND LINK

1. Remove the windshield wiper blade and arm assembly.

2. Remove the pivot shaft retaining nut, bezel and gasket.

3. Disconnect the wiper link from the motor and remove the link and pivot shaft assembly.

4. Position the link and pivot shaft assembly on the cowl and wiper motor. Connect the link to the motor.

5. Install the pivot shaft to the cowl and install the gasket, bezel, and retaining nut.

6. Install the wiper blade and arm assembly.

7. Check the pivot shaft and link operation.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

SINGLE-SPEED ELECTRIC WIPER MOTOR

A disassembled view of the single-speed wiper motor is shown in Fig. 11.

1. Remove the gear cover retaining screws, ground terminal and cover.

2. Remove the idler gear and pinion thrust washer and gear.

3. Remove the motor through bolts, motor housing, switch terminal insulator sleeve, and armature. **Do not pound the motor housing magnet assembly as the ceramic magnets may be damaged.**

4. Remove the armature end play adjusting set screw.

5. Mark the position of the output arm with respect to the output shaft, for assembly. Remove the output arm retaining nut, output arm flat washer, output gear and shaft assembly, thrust washer, and parking switch lever.

6. Remove the brushes and brush springs.

7. Remove the brush plate and switch assembly, and remove the switch contact to parking lever pin from the gear housing.

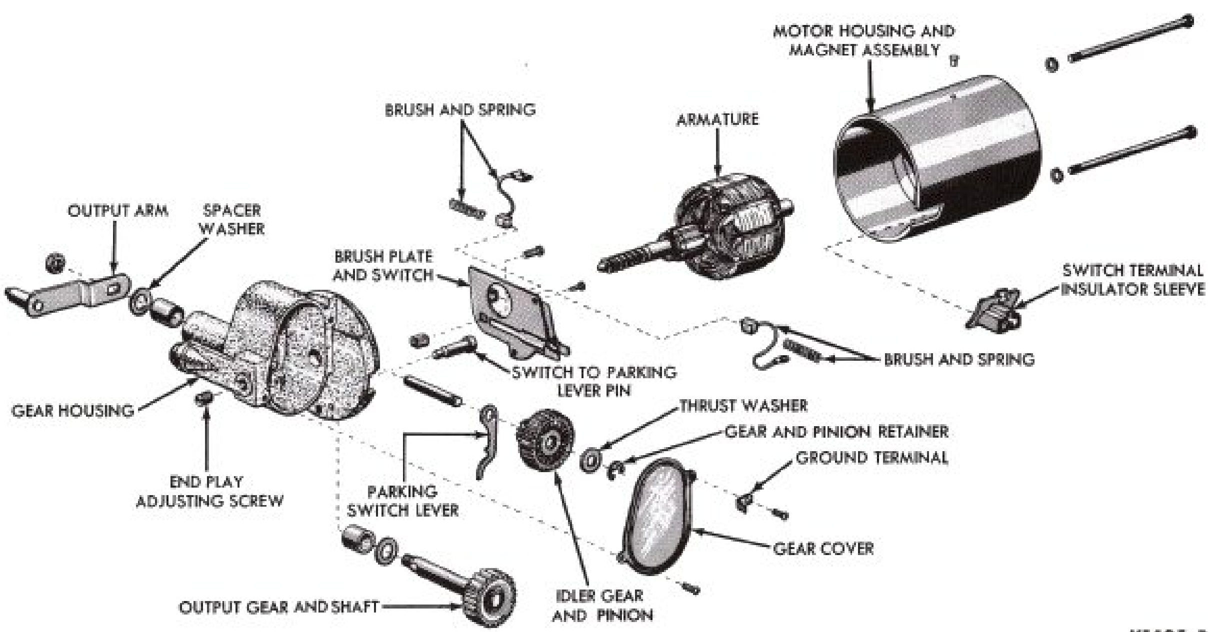


FIG. 11—Disassembled Single-Speed Wiper Motor

TWO-SPEED ELECTRIC WIPER MOTOR

The two-speed electric motor may be disassembled for service of the drive mechanism parts.

1. Remove the gear housing cover plate and gasket (Fig. 12).

2. Remove the output shaft retainer and spacer washer.

3. Remove the crankpin bearing retainer and remove the spacer washer and cam return spring assembly.

4. Remove the arm and link assembly.

5. Remove the crankpin bearing cam.

6. Remove the input gear retainer and outer spacer shim, and remove the input gear and inner spacer shim.

7. Remove the wiper arm lever nut and lock washer.

8. Remove the wiper arm lever and spacer, and remove the output shaft and gear assembly from the housing.

9. The output gear may be removed from its shaft by tapping with a fiber hammer. Be careful not to damage the end of the shaft.

The worm drive gear and armature assembly is not serviced.

PARTS REPAIR OR REPLACEMENT

All parts on both the single-speed and two-speed wiper are replaced and not repaired.

ASSEMBLY

SINGLE SPEED ELECTRIC WIPER MOTOR

1. Install the parking switch lever on the gear and pinion shaft with the cam rider pointing toward the gear housing output shaft hole. Make certain that the lever bottoms against the casting.

2. Apply a film of Sun Prestige grease to the output gear teeth and shaft bearing surface. Place the thrust washer on the shaft and insert the shaft in the bearing. Make certain that the parking switch lever is clear of the cam and gear assembly.

3. Place the spacer washer on the shaft, position the output arm on the shaft in the marked position from which it was removed, and install the mounting nut.

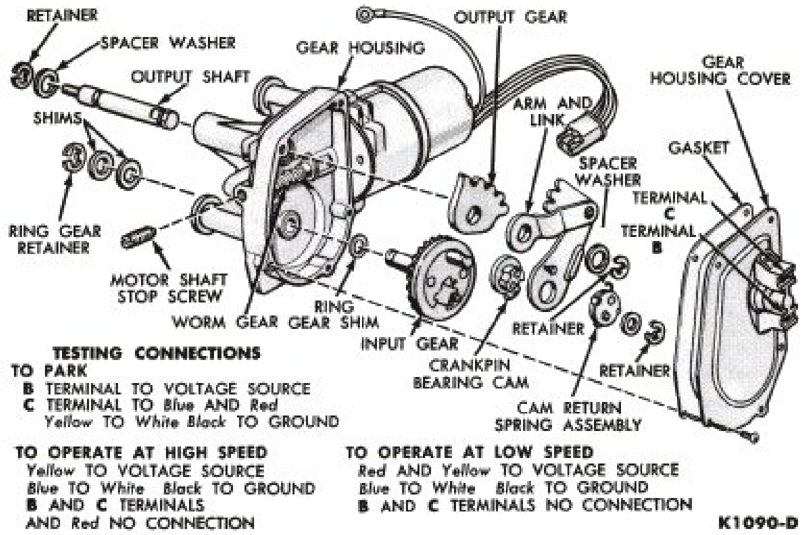


FIG. 12—Two-Speed Wiper Motor

4. Position the brush springs and brushes in the holders and wrap wire around them to hold them in the fully retracted position. Push the insulated brush connector onto the switch terminal.

5. Place the switch-contact to parking-lever pin in the gear housing. Position the brush plate assembly to the housing and install the mounting screws. Adjust the switch contact points by turning the adjusting screws clockwise until the inner contact points just open. Then back off the adjusting screw (counterclockwise) one and one half turns. Make this adjustment with the parking lever riding on the lower part of the output gear cam. Then insert a 0.030-inch feeler gauge between the center and outer contact points. Bend the outer arm to attain the 0.030-inch gap.

6. Apply Sun Prestige grease to the ball bearing in the end of the armature shaft. Position the armature shaft in the gear housing and remove the brush retracting wires.

7. Holding the armature in position, install the terminal insulating sleeve, motor housing and magnet assembly, and through bolts. Seal the area where the terminal insulator sleeve seats against the motor and gear housings.

8. Apply Sun Prestige grease to the worm gear and idler gear, and install the idler gear, thrust washer and retainer.

9. Install the armature shaft end play adjusting screw and adjust the end play to 0.003-inch.

10. Apply a generous amount of Sun Prestige grease to the area around the end of the armature shaft. Install the gear housing cover and ground terminal.

TWO-SPEED ELECTRIC WIPER MOTOR

1. Tighten the motor cover. Adjust the motor shaft end play to 0.000-0.005 inch by turning the shaft stop screw. Measure with a feeler gauge between the stop screw and the motor shaft.

2. Install the input gear shim on the input gear shaft and install the gear in the housing. Adjust the end play to 0.005 to 0.010 inch by adding or removing shims under the input gear retainer. Install the retainer.

3. Install the output gear on the output shaft. Make sure that the gear is bottomed on the shaft.

4. Install the output shaft and gear assembly into the housing with the gear teeth facing the motor. Install one spacer washer to the outside end of the output shaft and assemble the wiper arm lever to the output shaft, with the linkage studs

facing away from and above the shaft. Secure the lever with a lock washer and nut.

5. Place the bearing cam on the crankpin with the small diameter portion of the cam facing outward.

6. Install the arm and link assembly to the bearing cam. As the arm is placed on the shaft, the gears must be meshed and the link which is riveted to the arm must be installed to the output shaft at the same time. Proper gear indexing is obtained when the bottom tooth of the arm and gear segment will be in mesh with the bottom valley of the output shaft gear.

7. Install the output shaft spacer washer and retainer. Check the end play of the output shaft (0.005-0.010 inch). Remove or install spacer washers under the shaft retainer to adjust the end play.

8. Install the cam return spring assembly.

9. Install the bearing spacer and retainer. If the retainer cannot be installed, one or more coils of the spring clutch are probably out of place. If the bearing has excessive end play on the crankpin, the projection of the bearing may ride out of the semi-circular slot in the end plate. Add spacer washers under the retainer if necessary.

10. Apply generous amounts of Sun Prestige grease to all moving parts. Install the gear housing cover plate.

When operating the unit on the bench, do not place hands or fingers between the wiper lever and the case, or inside the gear housing, as considerable power is developed by the gear reduction.

PART 15-5 SPECIFICATIONS

BULB CHART—FALCON

Unit	Candle Power or Wattage	Trade Number
Headlight	50/40 W.	6012
Front Turn Signal/Parking	4/32 C.P.	1157 (Clear)
Rear Turn Signal and Stop/Tail	4/32 C.P.	1157
Stop/Tail Only		
License Plate	4 C.P.	1155
Back-up Lights	32 C.P.	1156
Dome Light	15 C.P.	1003
Instrument Panel Indicators:		
Hi Beam	2 C.P.	1895
Oil Pressure	2 C.P.	1895
Generator	2 C.P.	1895
Turn Signal	2 C.P.	1895
Parking Brake Warning	2 C.P.	1895
Illumination		
Speedometer	2 C.P.	1895
Cluster	2 C.P.	1895
Heater Control	2 C.P.	1895
Clock	2 C.P.	1895
Radio Dial	2 C.P.	1891
Courtesy and/or Map (Door Mounted)	6 C.P.	631
Automatic Transmission Control	2 C.P.	1895

CIRCUIT PROTECTION—FALCON

Circuit	Protective Device	Location
Headlights	Circuit Breaker	Incorporated in Lighting Switch
Instrument Panel, Dome, and All Exterior Lights, Except Headlight	3AG-15 or AGC-15 Fuse	Fuse Panel on Lighting Switch
Turn Signals and Back-up	SFE-14 Fuse	Fuse Panel on Lighting Switch
Radio	SFE-7.5 Fuse	Fuse Panel on Lighting Switch
Heater Blower	SFE-14 Fuse	Fuse Panel on Lighting Switch
Electric Windshield Wiper (Single Speed) (Dual Speed)	Circuit Breaker Circuit Breaker	Integral with Motor
Cigar Lighter	Reset Circuit Breaker	On Back of Cigar Lighter Socket
Air Conditioner	3AG-15 or AGC-15 Fuse	Cartridge in Feed Wire
Spot Light	SFE-7.5 Fuse	Cartridge in Feed Wire
Instrument Panel Light Rheostat	1AG-1 or AGA-1 Fuse	Cartridge in Feed Wire
Clock	1AG-2 or AGA-2 Fuse	Fuse Panel on Lighting Switch

BULB CHART—COMET

Unit	Candle Power or Wattage	Trade Number
Headlight No. 1 (Inner)	37.5 W.	4001
Headlight No. 2 (Outer)	37.5/50 W.	4002
Front Turn Signal/Parking	4/32 C.P.	1157
Rear Turn Signal and Stop/Tail	4/32 C.P.	1157
License Plate	4 C.P.	1155
Back-up Lights	21 C.P.	1141
Spot Light	30 W.	4405
Luggage Compartment	6 C.P.	631
Dome Light	15 C.P.	1003
Instrument Panel Indicators:		
Hi Beam	2 C.P.	1895
Oil Pressure	2 C.P.	1895
Generator	2 C.P.	1895
Turn Signal	2 C.P.	1895
Parking Brake Warning	2 C.P.	1895
Illumination		
Speedometer	2 C.P.	1895
Cluster	2 C.P.	1895
Heater Control	2 C.P.	1895
Clock	2 C.P.	1895
Radio Dial	2 C.P.	1891
Courtesy and/or Map (Door Mounted)	6 C.P.	631
Automatic Transmission Control	2 C.P.	1895

CIRCUIT PROTECTION—COMET

Circuit	Protective Device	Location
Headlights	Circuit Breaker	Incorporated in Lighting Switch
Instrument Panel, Dome, and All Exterior Lights, Except Headlight	3AG-15 or AGC-15 Fuse	Fuse Panel on Lighting Switch
Turn Signals and Back-up	SFE-14 Fuse	Fuse Panel on Lighting Switch
Radio	SFE-7.5 Fuse	Fuse Panel on Lighting Switch
Heater Blower	SFE-14 Fuse	Fuse Panel on Lighting Switch
Electric Windshield Wiper (Single Speed) (Dual Speed)	Circuit Breaker Circuit Breaker	Integral with Motor
Cigar Lighter	Reset Circuit Breaker	On Back of Cigar Lighter Socket
Air Conditioner	3AG-15 or AGC-15 Fuse	Cartridge in Feed Wire
Spot Light	SFE-7.5 Fuse	Cartridge in Feed Wire
Instrument Panel Light Rheostat	1AG-1 or AGA-1 Fuse	Cartridge in Feed Wire
Clock	1AG-2 or AGA-2 Fuse	Fuse Panel on Lighting Switch

VENTILATING, HEATING, AND ACCESSORIES — GROUP 16

PART 16-1 GENERAL VENTILATING, HEATING, AND ACCESSORIES SERVICE

1 DIAGNOSIS AND TESTING

VENTILATING AND HEATING TROUBLE DIAGNOSIS GUIDE

INSUFFICIENT OR NO HEAT	1. Burned out fuse or loose wires to the heater blower. 2. Defective motor ground, or defective blower motor. 3. Fan loose on motor shaft, or motor stalled. 4. Defective heater blower switch. 5. A kinked, clogged, or collapsed water hose. 6. Improperly connected heater hoses. 7. Plugged heater core, or air outlet. 8. Improperly installed or defective engine thermostat. 9. Incorrectly installed and adjusted control cables. 10. Air leaks in the body.
INSUFFICIENT OR NO DEFROSTING	1. Improperly adjusted defroster control cable, or disconnected defroster hose. 2. Binding defroster valve. 3. Plugged or loose defroster nozzle, or obstructed defroster openings at windshield. 4. Defroster hoses not properly attached at plenum.
TOO MUCH HEAT	1. Incorrectly adjusted blend-air valve.

AIR CONDITIONING TROUBLE DIAGNOSIS GUIDE

INSUFFICIENT OR NO COOLING	1. Inoperative magnetic clutch. 2. Inoperative blower, motor, or switch. 3. Obstructed air passages. 4. Complete loss of charge (No foam in sight glass at system start-up). 5. Partial loss of charge (Continuous foam in sight glass after start-up). 6. Service valves improperly set. 7. Inoperative vacuum servo. 8. Suction pressure low, discharge pressure OK. 9. Suction pressure high, discharge pressure OK.

CONTINUED ON NEXT PAGE

AIR CONDITIONING TROUBLE DIAGNOSIS GUIDE (Continued)

INSUFFICIENT OR NO COOLING (Continued)	10. Discharge pressure low, suction pressure high. 11. Compressor defective, or loose or broken compressor belt. 12. A/C thermostat defective. 13. Clutch lead disconnected or broken. 14. Expansion valve inoperative—stays open or closed. 15. Plugs left in compressor under service valve.
NOISY COMPRESSOR	1. Loose torn or misaligned belt. 2. Loose or slipping clutch. 3. Foreign material or damaged parts in compressor. 4. Compressor loose on bracket.
COMPRESSOR VIBRATION	1. Broken or loose mounting bracket. 2. Loose clutch. 3. Loose belt.

RADIO TROUBLE DIAGNOSIS GUIDE

NO RECEPTION	1. Burned out fuse. 2. Defective antenna. 3. Shorted speaker lead or defective speaker. 4. Reversed battery polarity. Make certain that voltage is available at the "A" lead (12 Volts). **Be sure to turn off the radio receiver before removing or installing the speaker.** If radio still will not play, remove the receiver for a major repair.
NOISY OR ERRATIC RECEPTION	**NOISY RECEPTION—ENGINE NOT RUNNING** 1. Loose connections. **NOISY RECEPTION—ENGINE RUNNING** 1. Defective suppression equipment. 2. Suppression condensers not properly grounded. 3. Receiver not properly grounded to instrument panel. **NOISY RECEPTION—CAR IN MOTION** 1. Loose or broken lead-in cable. 2. Loose or defective radio antenna. 3. Defective wheel static collector.
DISTORTED OR GARBLED SOUND	1. Voice coil rubbing on center pole piece of speaker magnet. 2. Torn speaker cone. 3. Foreign material on cone. 4. Bent or twisted speaker mounting. **Be sure to turn off the radio receiver before removing or installing the speaker.**
WEAK RECEPTION	1. Poor adjustment of the antenna trimmer (AM only). 2 Beyond normal reception distance from station (FM only). 3. Defective antenna. If FM reception is poor, be sure that antenna is at 30-32 inch height before trying a new antenna.
NO SOUND FROM ONE SPEAKER	1. One speaker defective. 2. Wiring to dead speaker defective. Operate fader to determine speaker at fault.

TESTING

HEATER CURRENT DRAW TEST

Connect an ammeter as shown in Fig. 1. The blower motor will operate independently of the control switch, and the current draw of the motor will be indicated on the ammeter. Normal current draw should be to specifications.

AIR CONDITIONING LEAK TEST

Attach the manifold gauge set (Fig. 2). Leave both manifold gauge valves at the maximum clockwise position. Set both service valves at the center position. Both gauges should now show approximately 60 to 80 pounds pressure at 75°F. If very little or no pressure is indicated, leave the vacuum pump valve closed, open the Refrigerant-12 tank valve, and set the low pressure manifold gauge valve to the counter-clockwise position. This opens the system to tank pressure. Check all connections, and the compressor shaft seal for leaks, using a flame type leak detector (Fig. 3). Follow the directions with the leak detector. The smaller the flame the more sensitive it is to leaks. Therefore, to insure accurate leak indication keep the flame as small as possible. The copper element must be red hot. If it is burned away, replace the element. Hold the open end of the hose at each suspected leak point for two or three seconds (Fig. 4). The flame will normally be almost colorless. The slightest leak will be indicated by a bright color to

the flame. Be sure to check the manifold gauge set and hoses for leaks as well as the rest of the system.

If the surrounding air is permeated with refrigerant gas the leak detector will indicate this gas all the time. Good ventilation is necessary to prevent this situation. A fan, even in a well ventilated area, is very helpful in removing small traces of refrigerant vapor.

2 COMMON ADJUSTMENTS AND REPAIRS

NOT APPLICABLE

See In-Car Adjustment and Repair (Part 16-2) VENTILATING AND HEATING.

3 CLEANING AND INSPECTION

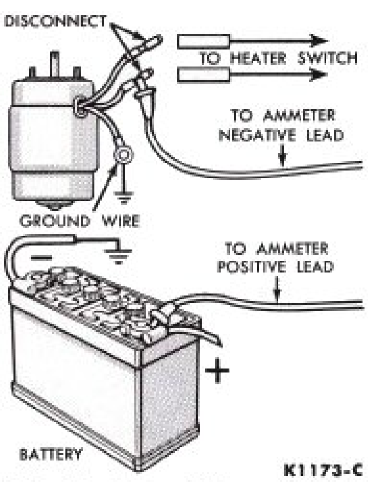


FIG. 1—Heater-Motor Current Draw Test

VENTILATING AND HEATING

Whenever the battery ground cable is removed, make certain the cable clamp and the battery terminal post are clean and dry before assembly.

AIR CONDITIONING

On compressor clutch installations, carefully remove any burrs or dirt that may be on the compressor shaft. The shaft must be dry and brightly polished. Then install the key in the shaft.

When the compressor is disassembled, completely clean all surfaces of shreds and foreign objects.

If the compressor shaft seal is being replaced, inspect the compressor internally and clean out dirt or chips as required.

When installing a new control assembly or parts, inspect for dirt and foreign objects. Also check for cleanliness of hoses and see that they are not pinched, or cracked.

See also Ventilating and Heating in this section.

COMPRESSOR OIL LEVEL CHECK

Under normal conditions when the air cooling system is operating satisfactorily the compressor oil level need not be checked. There is no place for the oil to go except inside the sealed system. When the car is first started some of the oil will be pumped into the rest of the system. After 15 minutes of operation, most of the oil is returned to the compressor crankcase.

Check the compressor oil level only if a portion of the refrigerant system is being replaced or if there was a leak in the system and the refrigerant is being replaced.

Check the oil after the system has been charged and has been operating at an engine speed of 1500 rpm for 15 minutes in 60°F. surrounding air temperature or above. Turn off the engine, and isolate the compressor. (See In Car Adjustments and Repair Part 16-3). Remove the oil filler plug from the compressor, insert a flattened 1/8-inch diameter rod (Fig. 5) in the oil filler hole until it bottoms. The rod should show 7/8 inch of oil on Tecumseh compressors and 3/4 inch of oil on York compressors. This is equivalent to 11 ounces on Tecumseh and 10 ounces on York. It may be necessary to rotate the compressor crankshaft slightly (by hand) so that the dip rod will clear the crankshaft. If additional oil is needed in the compressor, add Suniso 5 or Capella E refrigerator compressor oil, or equivalent.

If more than 7/8 inch of oil is indicated, as might happen if a new compressor is installed and oil already in the system is pumped back to the compressor, draw out the ex-

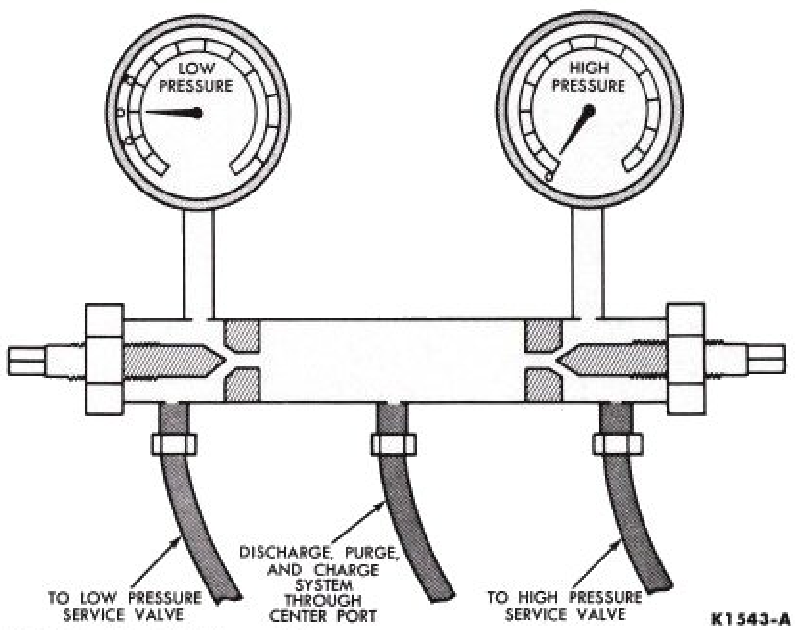


FIG. 2—Manifold Gauge Set

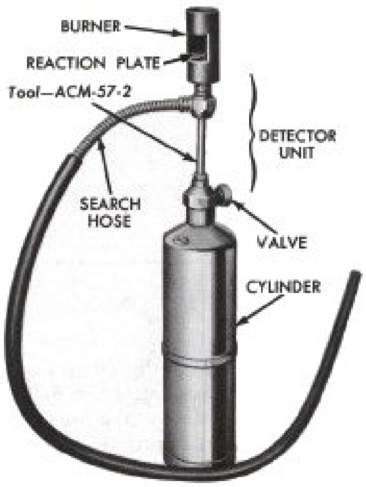


FIG. 3—Torch Type Leak Detector

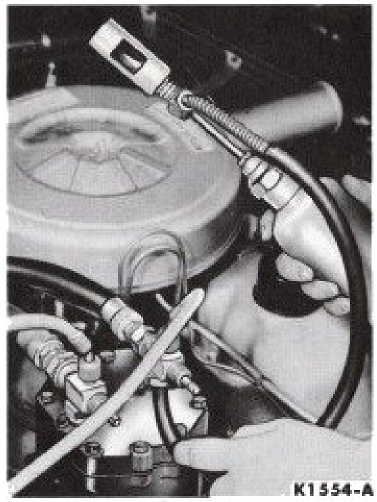


FIG. 4—Checking for Leaks

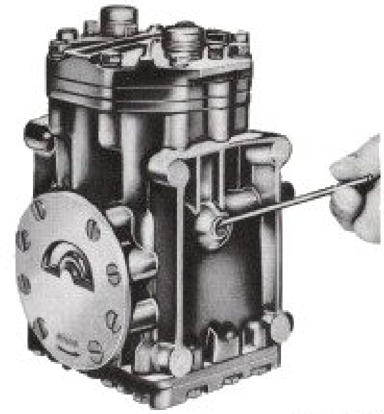


FIG. 5—Oil Level Check

cess oil until the proper quantity is indicated.

Replace the oil filler plug, then evacuate and connect the compressor back into the system. Be sure to check the compressor filler opening for leaks.

CHECKING SYSTEM PRESSURES

The pressures developed on the high pressure and low pressure side of the compressor indicate whether the system is operating properly.

Attach the manifold gauge set (Fig. 2). It will not be necessary to attach the Refrigerant-12 tank unless refrigerant is to be added to the system. Set both manifold gauge valves at the maximum clockwise or closed position. Set both service valves at the center position.

Check the system pressures with the engine running at 1500 rpm, all controls set for maximum cooling, and the front of the car at least five feet from any wall.

The actual pressures indicated on the gauges will depend on the temperature of the surrounding air and the humidity. High air temperatures along with low humidity, will give higher system pressures. The lowest figures given are for an ambient (surrounding air) temperature of 75°F., 50% relative humidity.

The low pressure gauge should indicate a pressure of from 12-50 pounds. The high pressure gauge should indicate a pressure of six or seven times the low pressure or 80-300 pounds.

At idle speed and a surrounding air temperature of 100°-110° F., the high pressure may go as high as 300 pounds or more. If it becomes necessary to operate the air conditioner under these conditions, keep the high pressure down with a fan directed at the condenser and radiator.

PART 16-2 VENTILATING AND HEATING

1 DESCRIPTION AND OPERATION

The fresh air heater is designed to function in conjunction with the right duct of the fresh air ventilating system (Fig. 1). The heater assembly couples to an outlet provided in the right cowl assembly. A door in the duct and two doors in the heater housing are operated by controls located on the instrument panel, allowing the selection of outside air for ventilation or heating (Fig. 2).

The defroster control lever operates a valve in the heater plenum chamber. Push the lever downward for proportionately more air to the defroster registers.

The PUSH FOR TEMP lever operates the blend-air valve in the heater blower housing. The blend-air door controls the amount of air flow through the heater core. Any intermediate position of the blend-air door allows both cool and heated air to be mixed in the plenum chamber for lower than maximum temperatures.

The PUSH FOR HTR lever operates a door in the right incoming air duct. When the lever is in the up position air from the cowl grille enters the passenger compartment through an opening under the right side of the instrument panel. A manually operated door closes the opening, or deflects air as desired. Pushing the lever downward allows air to enter the heater blower inlet duct.

To operate the blower motor, move the top lever from the center OFF position. Moving the lever to the left will give high speed operation, and moving it to the right will give low speed operation (Fig. 3).

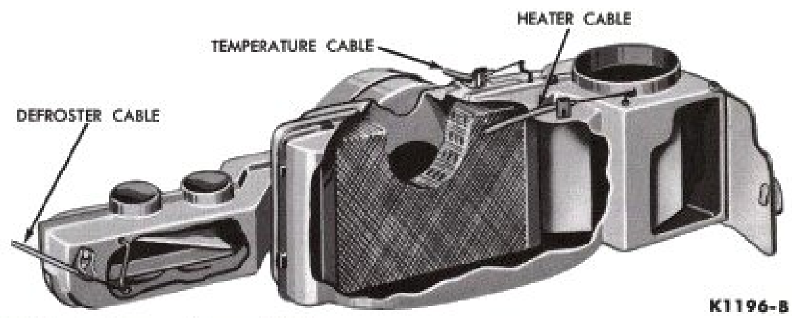


FIG. 2—Heater Control Cables

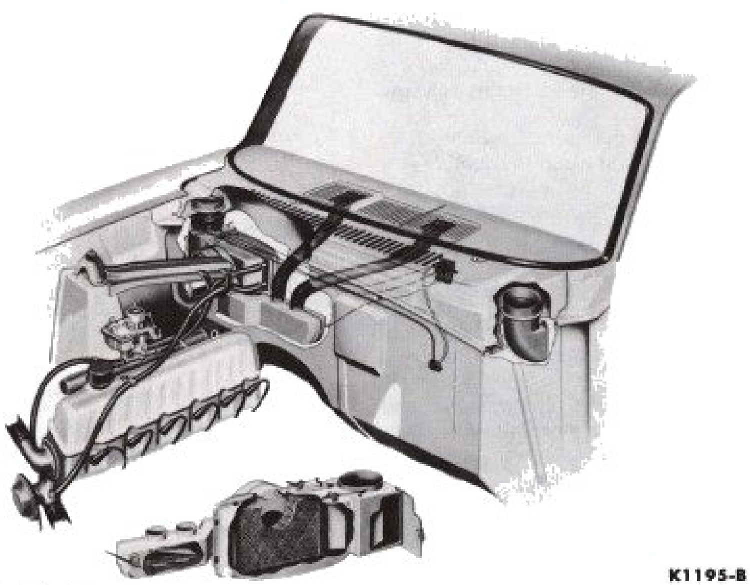


FIG. 1—Heater System

FIG. 3—Heater Controls

2 IN-CAR ADJUSTMENTS AND REPAIRS

CONTROL ADJUSTMENTS

To assure maximum temperature the following temperature control adjustments should be used.

1. Insert a ⅛-inch spacer between the temperature control lever (center lever) and bottom of the slot. Move the lever down until it is seated against the spacer.
2. Loosen the control cable retaining clip (at either end of the cable).
3. With the temperature control damper crank (heater assembly) held tightly in the "full heat position," tighten the control cable retaining clip screw.
4. Remove the spacer from the control head and check the lever travel. All overtravel (springback) should appear at the bottom of the lever travel.

3 REMOVAL AND INSTALLATION

HEATER

Most of the heater repairs can be performed with the heater assembly lying on the car floor. Therefore, the following procedure will not remove the heater assembly from the car. The heater core or plenum replacement procedures contain the additional required steps to remove the heater assembly from the car.

REMOVAL

1. Drain the cooling system.
2. Remove the glove box.
3. Disconnect the three control cables.
4. Disconnect the defroster hoses at the heater plenum.
5. Disconnect the heater hoses at the water pump and the carburetor heater. Remove the heater hoses from the retaining clips. On 8-cylinder models remove the hose from the choke clip.
6. Disconnect the wires at the heater motor and remove the ground wire to the dash panel retaining screw.
7. Remove the heater and motor assembly retaining nuts from the dash panel.
8. Disconnect the fresh air inlet rubber boot, pull the heater assembly from the dash panel and lay the heater assembly on the floor.

INSTALLATION

1. Position the heater assembly to the dash panel and install the retaining nuts.
2. Connect the heater motor wires to the wiring harness, and connect the heater motor ground wire to the dash panel with the retaining screw.
3. Connect the heater hoses and install the hose retaining clips.
4. Connect the fresh air inlet boot.
5. Connect the defroster hoses to the heater plenum.
6. Connect and adjust the three cables to the heater, and install the glove box.
7. Fill the cooling system, and check the system for leaks.
8. Bleed the system.

HEATER CORE

REMOVAL

1. Remove the heater assembly and lay the assembly on the car floor.
2. Remove the clips retaining the heater housing halves together and separate the halves.
3. Lift the heater core from the heater housing chamber.

INSTALLATION

1. Position the heater core in the forward half of the heater housing, assemble the housing, and install the retaining clips.
2. Position the assembly on the car floor.
3. Install the heater assembly.
4. Refill and bleed the cooling system and check for leaks.

HEATER BLOWER

REMOVAL

1. Remove the heater assembly and lay the assembly on the car floor.
2. Remove the blower motor and bracket to the blower housing retaining screws and remove the blower assembly.
3. Loosen the blower cage set screw and remove the blower cage from the motor.
4. Remove the blower motor mounting plate from the motor.

INSTALLATION

1. Install the blower motor mounting plate to the new motor.
2. Install the blower cage and tighten the set screw.
3. Install the heater motor and bracket to the blower housing.
4. Install the heater assembly.

DEFROSTER NOZZLES

1. Remove the defroster outlet register retaining screws and remove the register.
2. Disconnect the defroster hose at the plenum.
3. Remove the defroster nozzle retaining clips and remove the nozzle assembly.
4. Transfer the retaining clips to the new defroster nozzle assembly.
5. Install the defroster nozzle to the instrument panel.
6 Install the defroster outlet register.
7. Connect the hoses to the plenum.

BLOWER SWITCH

1. Loosen the screw in the knob.
2. Disconnect the wiring.
3. Remove one screw holding the blower switch to the control head assembly, and remove the switch.

HEATER CONTROL ASSEMBLY

Remove two screws from under the instrument panel to remove the control head assembly. Disconnect the three cables. Disconnect the blower switch wiring. Remove the control assembly.

PART 16-3 AIR CONDITIONING

1 DESCRIPTION AND OPERATION

The Ford air conditioner used on the Falcon, and the Mercury air conditioner used on the Comet, use a receiver, an expansion valve, an evaporator, a compressor, and a condenser. These parts are the standard units which are used in any air cooling system. Besides these major cooling components there is a liquid sight glass, an oil separator (integral with the compressor), a cooling unit thermostatic switch, and a blower assembly.

Fig. 1 shows an air conditioning system in schematic form. Arrows indicate the direction of refrigerant flow. Fig. 2 shows the electrical control circuit.

RECEIVER UNIT

The air cooling system stores the liquid Refrigerant-12 under pressure in a combination receiver and dehydrator (Fig. 1). The pressure in the receiver normally varies from about 80 to 300 psi, depending on the surrounding air temperature and compressor speed.

The dehydrator serves the purpose of removing any traces of moisture that may have accumulated in the system. Even small amounts of moisture will cause an air cooling unit to malfunction. A fusible plug is screwed into the receiver. This will release the refrigerant before the refrigerant temperature exceeds 212°F.

EVAPORATOR UNIT

When the cooling system is in operation, the liquid Refrigerant-12 flows from the combination receiver and dehydrator unit through a flexible hose to the evaporator (Fig. 1) where it is allowed to evaporate at a reduced pressure.

EXPANSION VALVE

The rate of refrigerant evaporation is controlled by an expansion valve (Fig. 1) which allows only enough refrigerant to flow into the evaporator to keep the evaporator operating efficiently, depending on its heat load.

The expansion valve consists of the valve and a temperature sensing capillary tube and bulb. The bulb is clamped to the outlet pipe of the evaporator. Thus the valve is controlled by evaporator outlet temperature.

The restricting effect of the expansion valve at the evaporator causes a low pressure on the low pressure side of the system of 12-50 psi, depending on the surrounding air temperature and compressor speed.

COMPRESSOR UNIT

The evaporated refrigerant leaving the evaporator (now in the form of a gas) at a pressure of 12-50 psi is pumped by the compressor, located on the engine (Fig. 3), into the top of the condenser, located in front of the radiator.

The compressor maintains a pressure on its high pressure side of from 80-300 psi, depending on the surrounding air temperature and compressor speed.

As the now heated and compressed refrigerant gas flows down through the condenser, it is cooled by air passing between the sections of the condenser. The cooled, compressed refrigerant gas condenses to liquid refrigerant which then flows into the receiver.

LIQUID SIGHT GLASS

A liquid sight glass is mounted in the high pressure refrigerant line between the receiver and the expansion valve (Fig. 1). The sight glass is used to check whether there is enough liquid refrigerant in the system.

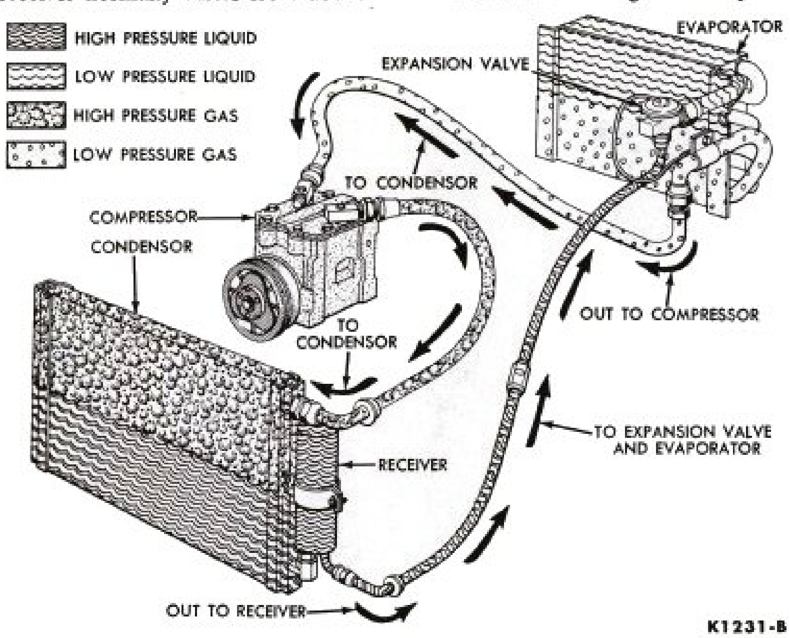


FIG. 1—Air Conditioning System

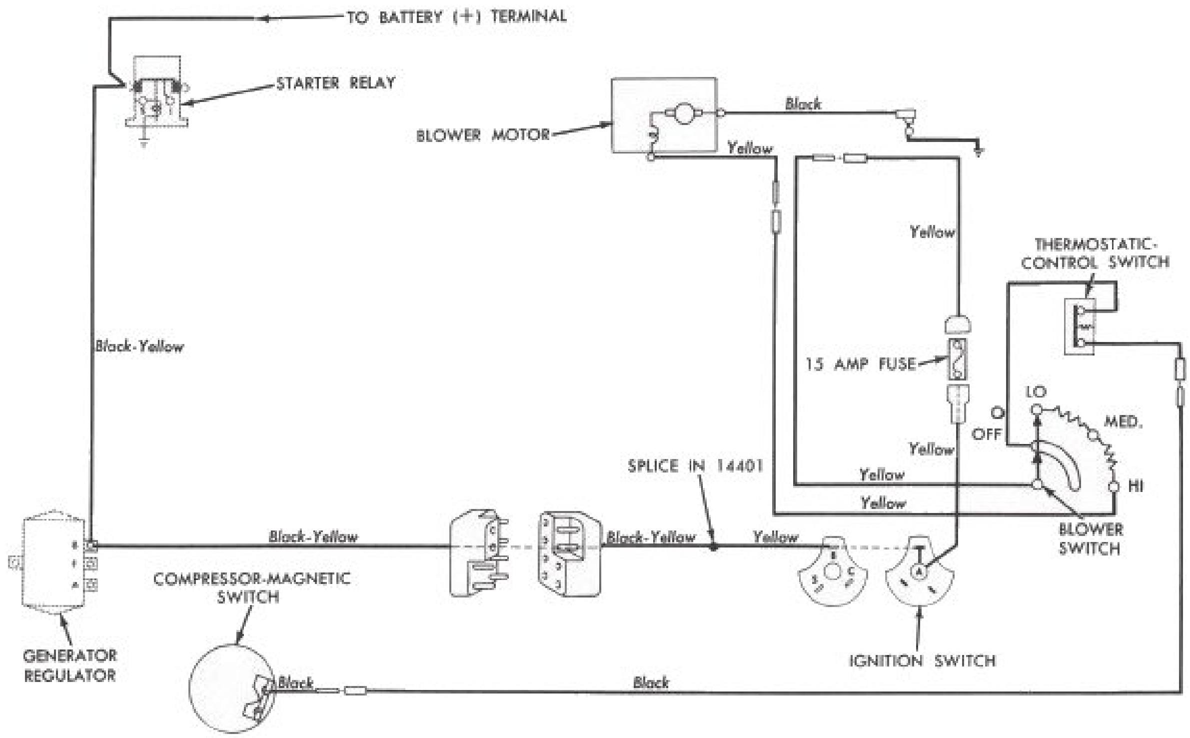


FIG. 2—Electrical Control Circuit

MAGNETIC CLUTCH

It is necessary to control the amount of cooling that the system produces. To accomplish this, the compressor is electrically cut in and out of operation by the use of a magnetic clutch pulley mounted on the compressor crankshaft (Fig. 1). The magnetic clutch is controlled by a thermostatic switch which has its temperature sensing tube inserted in the fins of the evaporator core.

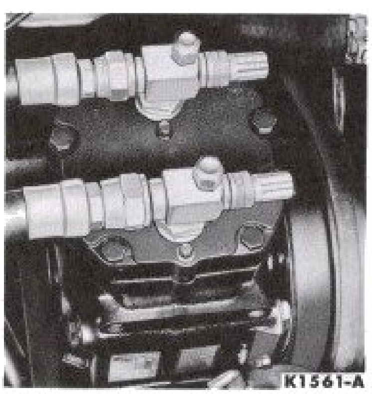


FIG. 3—Compressor Installed

THERMOSTATIC SWITCH

The thermostatic switch controls the operation of the compressor by controlling the compressor magnetic clutch. The temperature sensing tube of the switch is placed in contact with the evaporator fins. When the temperature of the evaporator becomes too cold, the thermostatic switch opens the magnetic clutch electrical circuit, disconnecting the compressor from the engine. When the temperature of the evaporator rises to the upper limit at which the thermostatic switch is set, the thermostatic switch closes and energizes the magnetic clutch. This connects the compressor to the engine, and cooling action begins again.

When the ignition switch is off

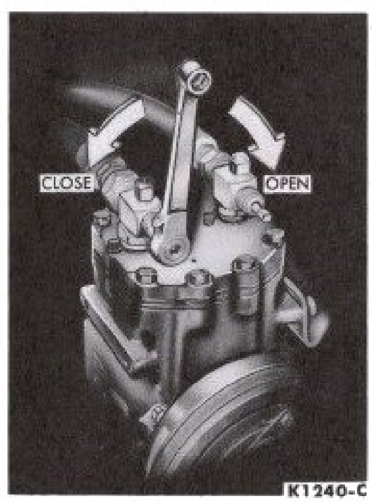


FIG. 4—Low Pressure Service Valve Gauge Port

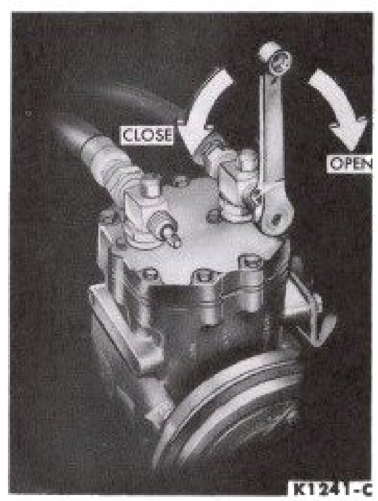


FIG. 5—High Pressure Service Valve Gauge Port

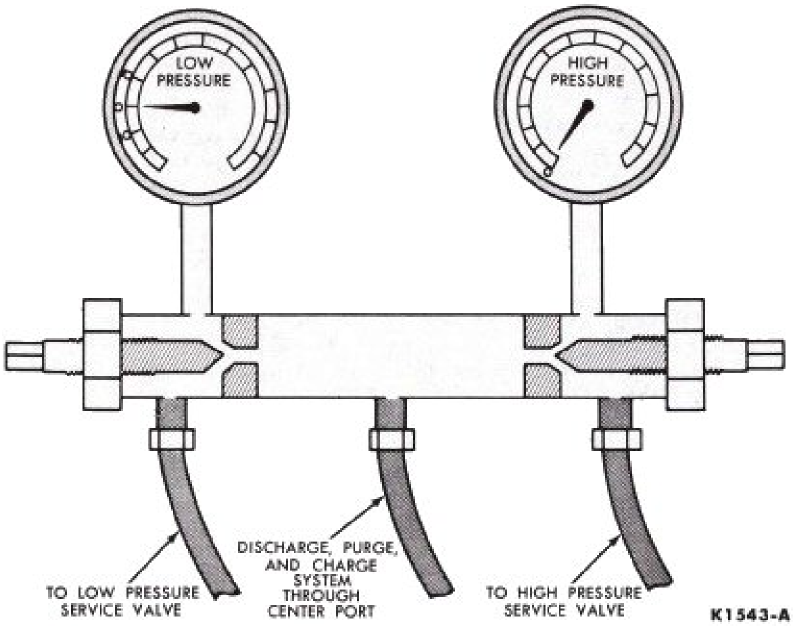


FIG. 6—Manifold Gauge Set

or the cooling control thermostatic switch is in the off position, the magnetic clutch is not energized, and the compressor can not operate.

When the ignition switch is on (engine running), and the cooling control is in the cooling range, the magnetic clutch is energized, the compressor is connected to the engine and the cooling system is in operation.

The thermostatic switch may be adjusted to maintain an average evaporator temperature of from 30°-60°F. The thermostatic switch operating differential temperature at any one setting is 6°F.

SERVICE VALVES

The service valves on the compressor are used to test and service the cooling system (Figs. 4 and 5). The high pressure service valve, mounted at the outlet to the compressor, allows access to the high pressure side of the system for attaching a pressure gauge, or a servicing hose.

The low pressure valve, mounted at the inlet to the compressor, allows access to the low pressure side of the system for attaching a pressure gauge or a servicing hose.

Both service valves may be used to shut off the rest of the system from the compressor during compressor service.

2 IN-CAR ADJUSTMENTS AND REPAIR

MAKING A PARTIAL CHARGE

Attach the manifold gauge set (Fig. 6). Open both manifold valves. Close the vacuum pump valve. Open the Refrigerant-12 tank valve. Purge the air from the high pressure hose by loosening the high pressure hose at the service valve, for a few seconds. Tighten the connection and set the high pressure manifold gauge valve at the maximum clockwise position. Loosen the low pressure gauge hose slightly at the low pressure service valve, for a few seconds, to purge the air from the hose. Tighten the connection. Set both service valves at the center position. (Fig. 7).

Run the engine at 1500 rpm with all controls at the maximum cold position. Charge the system until all foam disappears from the sight glass, and then add ¼ pound of Refrigerant-12. Shut the Refrigerant-12 tank valve.

It may be necessary to place the Refrigerant-12 tank in a container of hot water at about 150°F. to force the gas from the tank during charging.

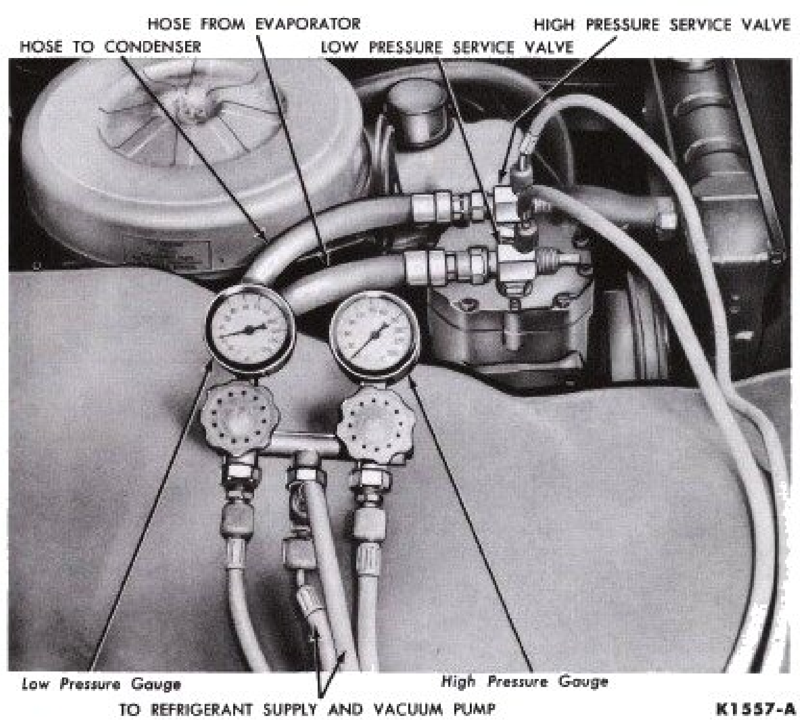


FIG. 7—Charging the Air Conditioning System

Never heat the Refrigerant-12 tank with a torch. A dangerous explosion may result.

Set both service valves at the maximum counterclockwise position. Remove the gauge set, and cap the service valve gauge ports and valve stems.

MAKING A COMPLETE CHARGE

Check for leaks first, release the pressure, then evacuate the system. Leave both service valves at the mid-position and the vacuum pump valve closed. Leave the low pressure manifold gauge valve at the maximum counterclockwise or open position. Set the high pressure manifold gauge valve at the maximum clockwise or closed position. Set all controls to the maximum cold position.

Open the Refrigerant-12 tank valve. Run the engine at 1500 rpm. Charge the system until the sight glass is clear of foam, then add an additional ¼ pound of refrigerant.

During the charging, the high pressure may build up to an excessive value. This can be caused by an overcharge of refrigerant, or an overheated engine, in combination with high surrounding temperatures. Never allow the high pressure to exceed 240 pounds while charging. Stop the engine, determine the cause, and correct it.

After the proper charge has been made, close the Refrigerant-12 tank valve, and check the system pressures for proper operation. Set both service valves at the maximum counterclockwise position. Remove the gauge set, and cap the service valve gauge ports and valve stems.

CHARGING FROM SMALL CONTAINERS

Refrigerant-12 is available in one-pound cans. A scale is not necessary if these small containers are used instead of a tank.

Attach the hose, that would normally attach to the large tank (Fig. 7), to the special valve that is provided for the small cans. Close the valve (maximum clockwise position) and follow the procedure for leak testing, evacuating and charging the system as previously given.

For charging, attach a one-pound can of Refrigerant-12 to the special valve, and open the valve. Keep the can in an upright position. When the can is empty (no frost showing), close the valve, remove the empty can, attach a new one, and open the valve again.

Charge the system until the sight glass clears of foam then add an additional ¼ pound of refrigerant. Estimate the ¼ pound weight by observing the frost line on the one-pound can.

Check the system pressures, set both service valves at the maximum counterclockwise position. Remove the gauge set, and cap the service valve gauge ports and valve stems.

ISOLATING THE COMPRESSOR

To isolate the compressor from the system, turn both the high and the low pressure service valves to the extreme clockwise position (Figs. 4 and 5). Loosen the cap on the high pressure service valve gauge port, and allow the gas to escape until the compressor is relieved of refrigerant pressure.

Loosen the cap a small amount only, and do not remove it until the pressure is completely relieved.

To connect the compressor back into the system, evacuate the compressor at the high pressure service valve gauge port, close the vacuum pump valve, turn both service valves to the maximum counterclockwise position, and cap the high pressure service valve gauge port and service valve stems.

DISCHARGING THE SYSTEM

Discharge the refrigerant from the system before replacing any part of the system, except the compressor.

To discharge the system, connect the manifold gauge set to the system (Fig. 6). Do not connect the manifold center connection hoses to the Refrigerant-12 tank, or vacuum pump. Place the open end of these hoses in a garage exhaust outlet. Set the high pressure manifold gauge valve at the maximum counterclockwise or open position. Open the high pressure service valve at a slight amount (Fig. 5), and allow the refrigerant to discharge slowly from the system.

Do not allow the refrigerant to rush out, as the oil in the compressor will be forced out along with it.

EVACUATING THE SYSTEM

Attach the manifold gauge set, a tank of Refrigerant-12 and a vacuum pump to the system (Fig. 7). Make certain that the Refrigerant-12 tank valve is tightly closed. Set both service valves to the mid-position. Open both manifold valves. Release any pressure in the system. Open the vacuum pump valve and run the pump until the low pressure gauge reads at least 25 inches, and as close to 30 inches of vacuum as possible. Continue vacuum pump operation for 20 to 30 minutes to boil any moisture out of the system. Close the pump valve. Turn off the pump.

3 REMOVAL AND INSTALLATION

SAFETY PRECAUTIONS

The refrigerant used in the air conditioner system is Refrigerant-12. Refrigerant-12 is nonexplosive, noninflammable, noncorrosive, has practically no odor, and is heavier than air. Although it is classified as a safe refrigerant, certain precautions must be observed to protect the parts involved and the person who is working on the unit. **Use only Refrigerant-12.**

Liquid Refrigerant-12, at normal atmospheric pressures and temperatures, evaporates so quickly that it tends to freeze anything that it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from coming in contact with the skin and especially the eyes.

Refrigerant-12 is readily absorbed by most types of oil. It is therefore recommended that a bottle of sterile mineral oil and a quantity of weak boric acid solution be kept nearby when servicing the air conditioning system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out, then wash the eyes clean with the weak boric acid solution. Seek a doctor's aid immediately even though irritation may have ceased.

Always wear safety goggles when servicing any part of the refrigerating system.

The Refrigerant-12 in the system is always under pressure. Because the system is tightly sealed, heat applied to any part would cause this pressure to build up excessively.

To avoid a dangerous explosion, never weld, use a blow torch, solder, steam clean, bake body finishes, or use any excessive amount of heat on, or in the immediate area of, any part of the air cooling system or refrigerant supply tank, while they are closed to the atmosphere whether filled with refrigerant or not.

The liquid refrigerant evaporates so rapidly that the resulting refrigerant gas will displace the air surrounding the area where the refrigerant is released. To prevent possible suffocation in enclosed areas, always discharge the refrigerant from an air cooling system into the garage exhaust collector. Always maintain good ventilation surrounding the work area. **If the car is to be undercoated, make certain that the undercoating does not plug the evaporator drain tubes.**

Although Refrigerant-12 gas, under normal conditions, is non-poisonous, the discharge of refrigerant gas near an open flame can produce a very poisonous gas. This gas will also attack all bright metal surfaces. This poisonous gas is generated in small quantities when the flame-type leak detector is used. Avoid inhaling the fumes from the leak detector. **Make certain that Refrigerant-12 is both stored and installed in accordance with all state and local ordinances.**

When admitting Refrigerant-12 gas into the cooling unit, always keep the tank in an upright position. If the tank is on its side or upside down, liquid Refrigerant-12 will enter the system and damage the compressor. **In surrounding air temperatures above 90° F., prolonged engine idle will result in excessively high compressor pressures.**

EVAPORATOR

The evaporator assembly must be removed from the car before removing the evaporator core from the housing.

REMOVAL

1. Discharge the refrigerant from the system.
2. Disconnect the two wires from the unit, demount the evaporator assembly, and set the unit on the car floor.
3. Disconnect the refrigerant hoses and remove the unit from the car.
4. Remove the front panel, covers and the expansion valve from the unit. (See Expansion Valve Removal and Installation).
5. Remove the thermostatic switch temperature sensing tube from between the evaporator fins, remove the evaporator-to-base mounting screws and remove the evaporator from the base.

INSTALLATION

1. Attach the old expansion valve to the new evaporator and leak test the connection by capping the outlet of the evaporator and using a suitable reducing connector from the valve inlet to a rank of Refrigerant-12.
2. Position the evaporator on the base and install the two evaporator-to-base mounting screws.
3. Push the thermostatic switch sensing tube into the same relative position at about the center of the evaporator, but if the same core is being used position the sensing tube between the next two fins for good temperature conduction. Install the covers and front panel.
4. Set the assembly on the car floor, attach the refrigerant lines and leak test the connections.
5. Mount the assembly, connect the two wires, evacuate and charge the system.

EXPANSION VALVE

REMOVAL

1. Discharge the refrigerant from the system. Disconnect the two wires from the unit, demount the evaporator assembly, and set the unit on the car floor. Disconnect the refrigerant hoses and remove the unit from the car.
2. Remove the expansion valve protection shield.
3. Carefully slit the insulation covering the temperature bulb and remove the temperature bulb clamp. Then disconnect the valve from the inlet pipe and remove the valve.

INSTALLATION

1. Connect the new valve to the inlet pipe, and leak test the connection by capping the outlet end of the evaporator and using a suitable reducing connector from the valve inlet to a tank of Refrigerant-12. Position the temperature bulb to the outlet pipe, and install the bulb clamp. Be sure that the bulb, pipe, and clamp are clean and that the clamp is tight. Go over these parts with fine sandpaper to assure this.
2. Wrap the insulating material around the temperature bulb, pipe, and valve, and position the rubber seal over the pipe connections.
3. Install the expansion valve protection shield.
4. Position the assembly on the car floor, connect the refrigerant hoses and leak test the connections.
5. Mount the assembly, connect the wires, evacuate and charge the system.

CONDENSER

1. Discharge the refrigerant from the system.
2. Remove the front grille to radiator support bracket, and the hood latch.
3. Disconnect the refrigerant lines from the condenser and receiver. Remove the condenser mounting screws and remove the condenser receiver assembly.
4. Position and mount the new condenser, attach the refrigerant and install the grille to radiator support bracket and hood latch.
5. Check for leaks, evacuate and charge the system.

COMPRESSOR

REMOVAL

1. Isolate the compressor (see In-Car Adjustments and Repairs, Part 16-3) and disconnect the two service valves and hoses from the compressor (Fig. 8). Energize the clutch and loosen and remove the clutch mounting bolt.
2. Install a ⅝-11 bolt in the clutch drive shaft hole. With the clutch still energized, tighten the bolt to loosen the clutch from the shaft. Disconnect the clutch wire at the bullet connector.
3. Loosen the compressor mounting bolts. Slide the compressor toward the center of the engine, remove the drive belt and the clutch, and then remove the mounting bolts and the compressor.
4. With the compressor on the work bench, remove the key from from the shaft.

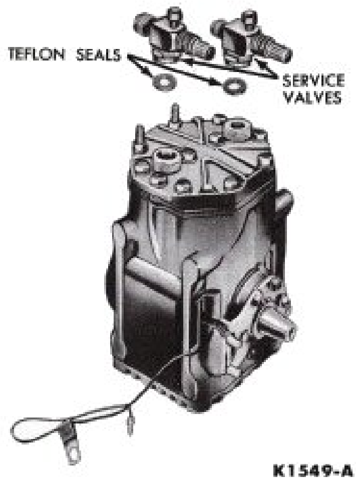


FIG. 8—Compressor Service Valves Removed

INSTALLATION

Before installing the compressor, see "Cleaning and Inspection — Air Conditioning" (Part 16-1).

1. Mount the clutch on the shaft and install the mounting screw and washer finger-tight. Place the compressor on the mounting bracket and install the four mounting bolts finger-tight.

2. Connect the clutch wire, energize the clutch and torque the clutch mounting bolt to specifications. **If the new compressor was shipped with a bolt and washer in the end of the crankshaft, remove and discard the bolt and use a bolt with a nylon insert in it.** Install and adjust the drive belt, and tighten the mounting bolts.

3. Install the service valves on the compressor using new gaskets. Tighten the service valve flared nuts to specifications. **Do not over-tighten the flared nuts.** The ROTO-LOK service valves can be rotated slightly on their seat without breaking the high pressure seal. This is not an indication of a loose valve. Leak test the compressor, then evacuate it and connect it back into the system.

4. Check the oil level in the compressor and add or remove oil if necessary.

COMPRESSOR COMPONENTS

All compressor removal and installation operations, except belt replacement, can be performed only after the unit has been isolated from the rest of the system. (See In-Car Adjustments and Repairs in this part).

VALVE PLATE

Removal

1. Isolate the compressor and disconnect the service valves. Remove the 12 head bolts.

2. Remove the cylinder head and valve plate from the top of the compressor body (Fig. 9). Do not tap or hit the head with any hard tool, as damage could result. (York compressors are made of aluminum).

3. Remove and discard all gaskets, and be sure to clean gasket shreds from all gasket surfaces. Examine the cylinders and top of the pistons, particularly in case of valve breakage. If there are score marks, replace the compressor assembly.

4. If the cylinders and pistons are in good condition, check the valve plate and valve reeds for damage. If the valve assembly is in good condition, it can be used again. If the valve plate is damaged, install the entire replacement kit which includes the valve plate, valve reeds, and the two gaskets (Fig. 9).

5. When the valve plate assembly is re-used, wash it in clean solvent and dry in dry air. Check the oil for dirt. If the system is not clean, replace the oil.

Installation

1. Starting with the valve plate gasket, assemble the parts in the order shown in Fig. 9. Insert the cylinder head bolts carefully to avoid damaging the gaskets. Before assembly apply a film of new refrigeration oil to both sides of both gaskets.

2. Tighten all bolts finger-tight, then torque the bolts ¼ turn at a time to specifications. Then tighten the remaining bolts in a sequence so those diagonally opposite are evenly drawn to the required torque.

3. Connect the compressor into the system. Check the oil level in the compressor, and add or remove oil if necessary. (See "Cleaning and Inspection", Part 16-1).

BELT

8-CYLINDER

1. Loosen the four compressor mounting bolts.

2. Slide the compressor toward the

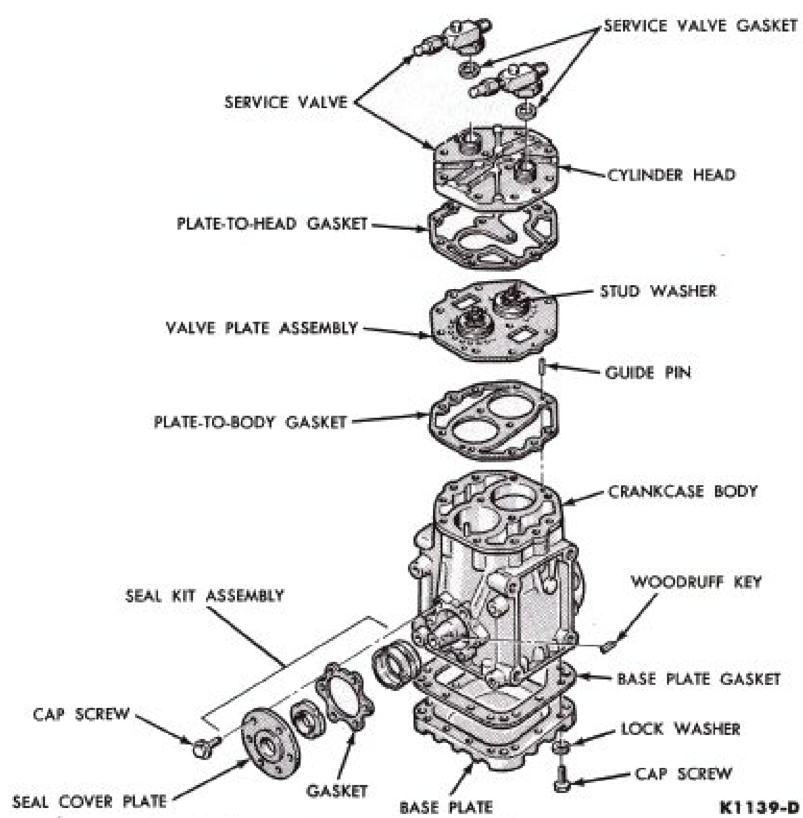


FIG. 9—York Cylinder Head and Valve Assembly

center of the car and remove the belt.

3. Place the new belt in position, and slide the compressor toward the outside of the car and carefully align the belt. Then tighten the four mounting bolts.

4. Adjust the belt tension to specifications, using the idler pulley.

6-CYLINDER

1. Loosen the generator mounting and adjusting screws, and swing the generator toward the center of the car until the old belt can be removed.

2. Install the new belt and adjust to specifications.

3. Tighten the generator mounting and adjusting screws.

CLUTCH

1. Energize the clutch and loosen and remove the clutch mounting bolt.

2. Install a 5/8-11 bolt in the clutch drive shaft hole. With the clutch still energized, tighten the bolt to loosen the clutch from the shaft, then remove the magnetic clutch.

3. Install the clutch, the clutch mounting bolt, and the washer.

4. Energize the clutch, and torque the bolt to specifications.

CRANKSHAFT SEAL

REMOVAL

1. Isolate the compressor, and remove it from the car. (See In-Car Adjustments and Repairs in this Part).

2. Remove the clutch and remove the Woodruff key.

3. Remove the seal plate bolts, and remove the plate and gasket. Do not mar the sealing surfaces, or the polished shaft surface.

4. Remove the carbon seal ring and seal housing assembly from the crankshaft. A disassembled view of the crankshaft seal assembly is in-included in Fig. 9.

5. Remove the base plate and inspect the compressor internally for foreign particles. Clean out as required.

6. Clean all old gasket material from the seal plate and the compressor. Make certain that the shaft, the seal plate and the compressor gasket surfaces are completely clean before installing the new seal.

INSTALLATION

1. Lubricate the new shaft seal parts in clean compressor oil, and position the seal assembly on the crankshaft, with the carbon ring toward the seal plate.

2. Position the new gasket on the compressor, center the crankshaft in the seal plate and install the seal plate.

3. Torque the bolts to specifications.

4. Make certain that there are no burrs or dirt on the compressor shaft. Then install the key, the belt, and the clutch.

5. Install the new base plate gasket and install the base plate. Add new compressor oil to specifications. (See Cleaning and Inspection, Part 16-1).

6. Install the compressor.

7. Adjust the belt tension and the belt alignment.

PART 16-4 RADIO

1 DESCRIPTION AND OPERATION

An AM radio is available for 1964; model 4TBD manufactured by Bendix for the Falcon, and model 4TME manufactured by Motorola for the Comet. An AM-FM radio model F4TBE manufactured by Bendix is available for the Comet. Figs. 1, 2 and 3 show the radio schematic diagrams.

2 IN-CAR ADJUSTMENT AND REPAIR

PUSH BUTTON ADJUSTMENT

Turn the radio on, and allow it to warm up for 15 minutes. Extend the antenna to a height of approximately 33 inches. Pull out the desired push button and reduce the volume to a low value. Tune in the desired station with the manual tuning knob. The station is correctly tuned in when the clearest tone is heard. Carefully push the button in all the way, then release it.

Adjust the remaining buttons and check all the positions for repeat accuracy. Repeat the procedure for any buttons that shift from the correct tuning point.

On the AM/FM radio push an AM button all the way in before adjusting the AM buttons. Push one FM button all the way in before adjusting the FM buttons.

3 REMOVAL AND INSTALLATION

RADIO RECEIVER

To remove the radio receiver, proceed as follows:

1. Pull the radio control knobs off and remove the nuts and washers retaining the radio to the instrument panel.

2. Disconnect the antenna lead at the right side of the radio (at the back of the AM-FM radio).

3. Disconnect the speaker lead.

4. Disconnect the radio lead wire at the fuse panel on the lighting switch and disconnect the pilot light wire. Remove the lead wire from the retaining clips.

5. Remove the radio support bracket to radio retaining nut.

6. Remove the radio assembly from the instrument panel.

7. Position the radio to the instrument panel, and then install the washers and retaining nuts at the knob shafts. Be sure the radio mounting stud enters the support bracket.

8. Install the radio support bracket retaining nut. Torque all mounting nuts to specifications.

9. Connect the antenna lead to the radio.

10. Connect the radio speaker lead.

11. Connect the radio power lead and the pilot light lead.

12. Install the radio control knobs.

13. Check the radio operation.

SPEAKER—FRONT

1. Disconnect the speaker wires from the radio receiver.

2. Remove the defroster and radio speaker outlet grille from the top of the instrument panel.

3. Remove the speaker retaining screws and lift the speaker from the instrument panel (Fig. 4).

4. Install the speaker to the instrument panel with the retaining screws.

5. Install the radio speaker outlet grille.

6. Connect the speaker wires to the radio, and check the radio operation.

SPEAKER—REAR

The rear seat speaker is accessible for replacement from the luggage compartment. On the station wagon the speaker is mounted on the left rear trim panel. Remove the trim panel to replace the speaker.

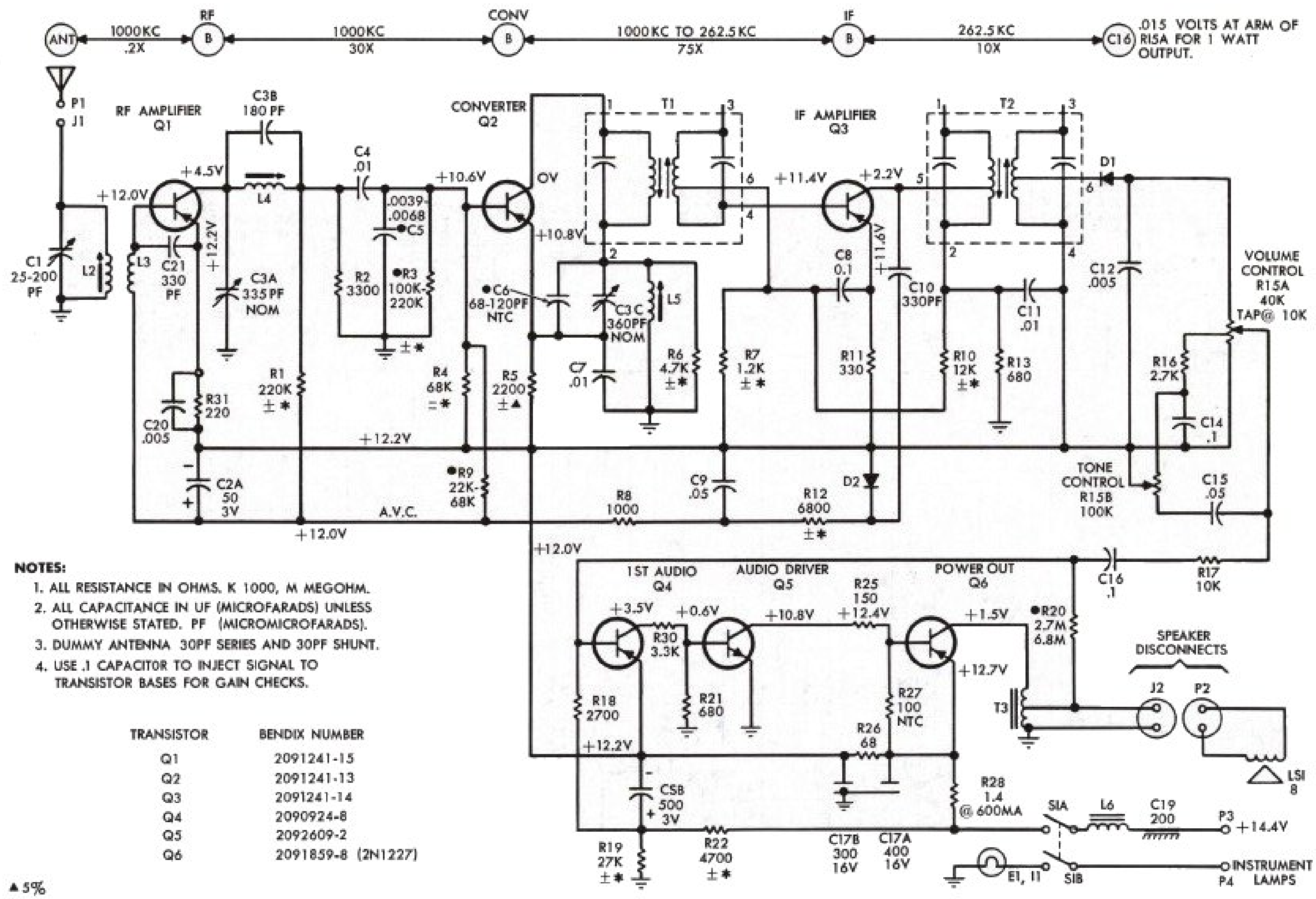
ANTENNA

1 Disconnect the antenna lead from the side of the radio receiver (at the back of the AM-FM radio). Tie a string to the end of the antenna lead.

2. Remove the antenna mounting nut, remove the spacer from the antenna, and remove the antenna assembly.

3. Tie the string to the new antenna lead.

4. Position the antenna assembly in the opening, put the spacer in



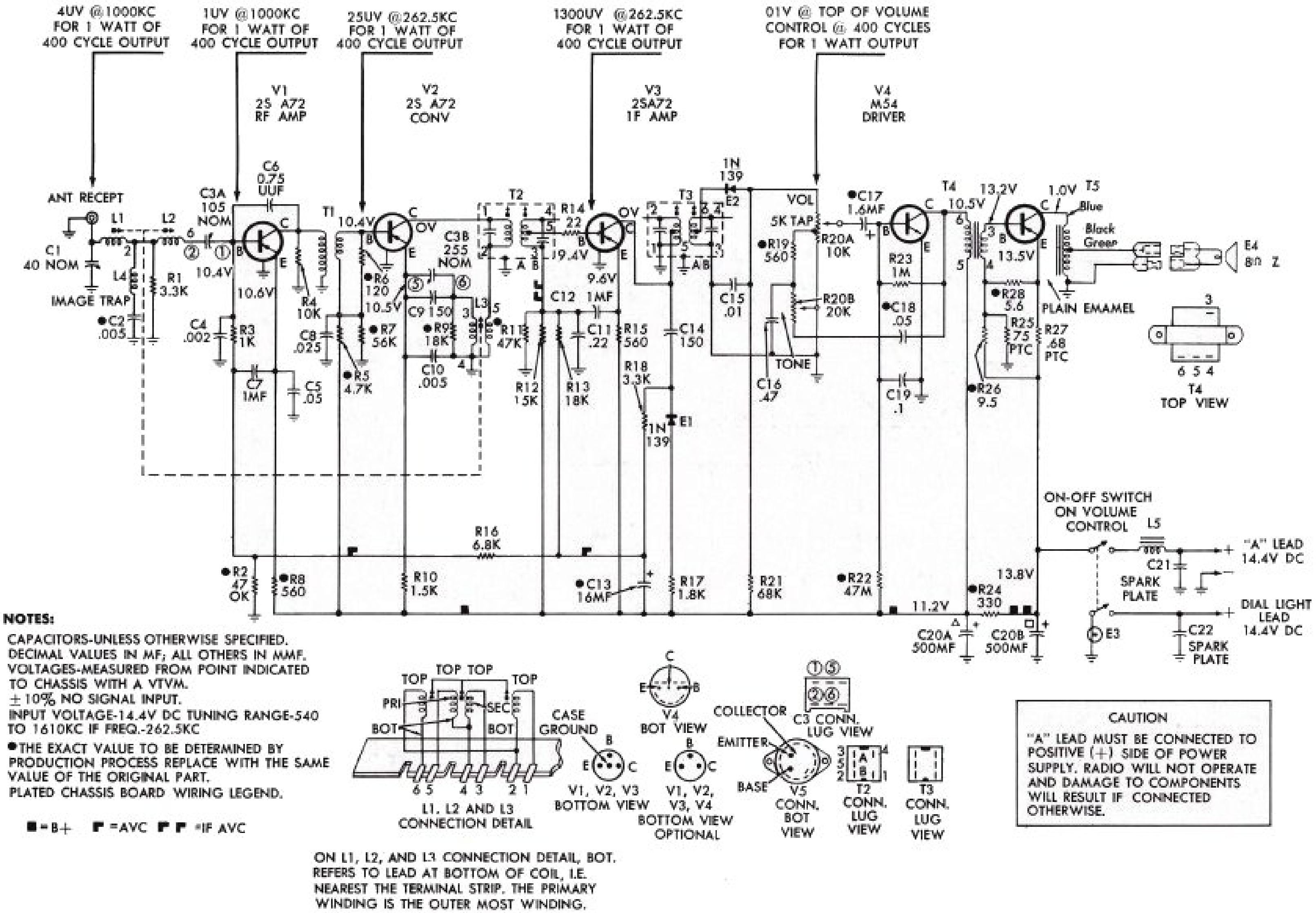
NOTES:

1. ALL RESISTANCE IN OHMS. K 1000, M MEGOHM.
2. ALL CAPACITANCE IN UF (MICROFARADS) UNLESS OTHERWISE STATED. PF (MICROMICROFARADS).
3. DUMMY ANTENNA 30PF SERIES AND 30PF SHUNT.
4. USE .1 CAPACITOR TO INJECT SIGNAL TO TRANSISTOR BASES FOR GAIN CHECKS.

TRANSISTOR	BENDIX NUMBER
Q1	2091241-15
Q2	2091241-13
Q3	2091241-14
Q4	2090924-8
Q5	2092609-2
Q6	2091859-8 (2N1227)

▲5%
∗10%
●EXACT VALUE DETERMINED BY PRODUCTION PROCESS-REPLACE WITH SAME VALUE AS ORIGINAL.

FIG. 1—Falcon Model 4TBD Radio Schematic

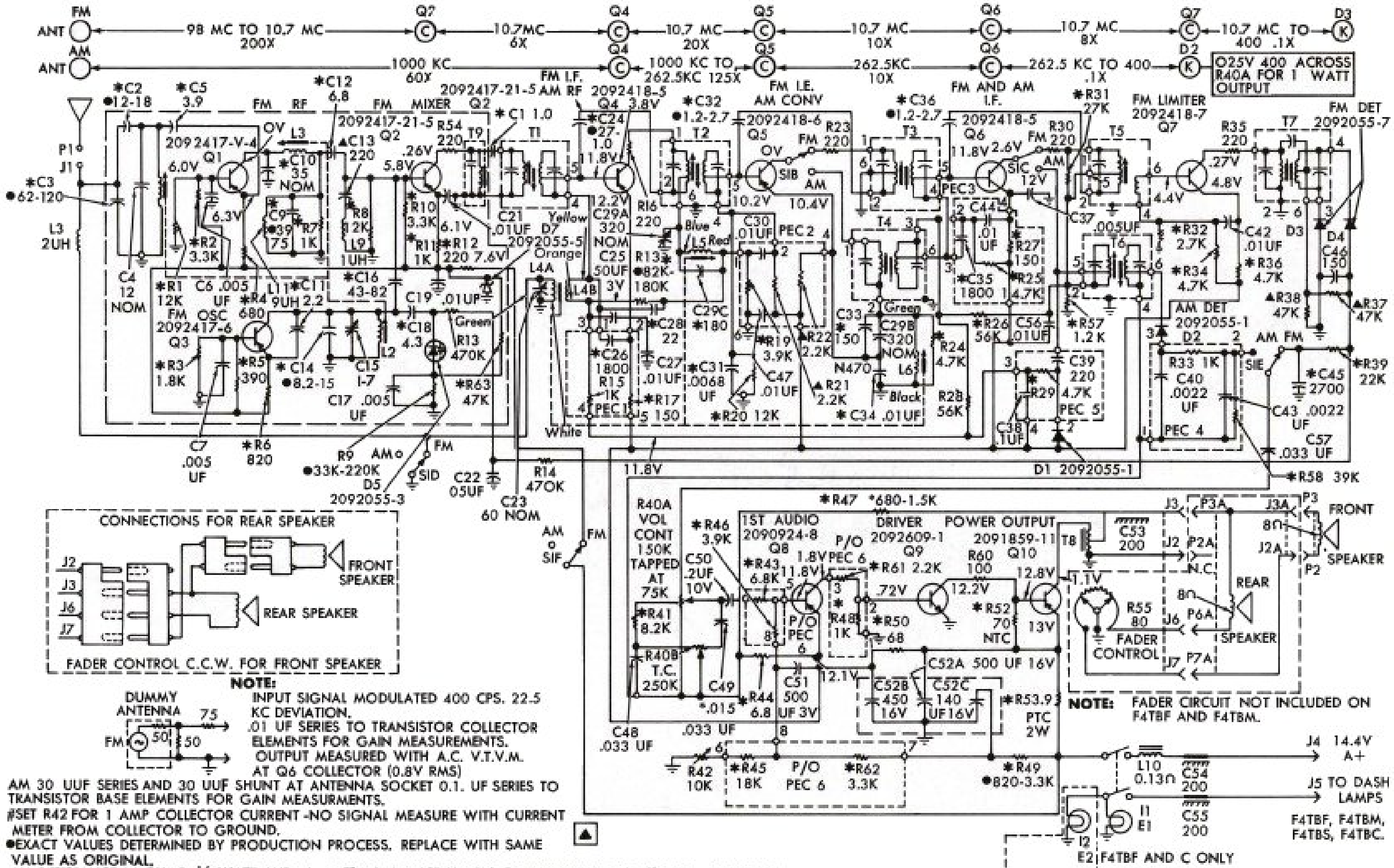


NOTES:

CAPACITORS-UNLESS OTHERWISE SPECIFIED. DECIMAL VALUES IN MF; ALL OTHERS IN MMF.
VOLTAGES-MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM.
±10% NO SIGNAL INPUT.
INPUT VOLTAGE-14.4V DC TUNING RANGE-540 TO 1610KC IF FREQ.-262.5KC
●THE EXACT VALUE TO BE DETERMINED BY PRODUCTION PROCESS REPLACE WITH THE SAME VALUE OF THE ORIGINAL PART.
PLATED CHASSIS BOARD WIRING LEGEND.

■=B+ ◤=AVC ◤◤=IF AVC

FIG. 2—Comet Model 4TME Radio Schematic



NOTE:
INPUT SIGNAL MODULATED 400 CPS. 22.5 KC DEVIATION.
.01 UF SERIES TO TRANSISTOR COLLECTOR ELEMENTS FOR GAIN MEASUREMENTS.
OUTPUT MEASURED WITH A.C. V.T.V.M. AT Q6 COLLECTOR (0.8V RMS)

AM 30 UUF SERIES AND 30 UUF SHUNT AT ANTENNA SOCKET 0.1. UF SERIES TO TRANSISTOR BASE ELEMENTS FOR GAIN MEASURMENTS.
#SET R42 FOR 1 AMP COLLECTOR CURRENT -NO SIGNAL MEASURE WITH CURRENT METER FROM COLLECTOR TO GROUND.
●EXACT VALUES DETERMINED BY PRODUCTION PROCESS. REPLACE WITH SAME VALUE AS ORIGINAL.
ALL RESISTANCE IN OHMS. ½ WATT AND ± 20% TOLERANCE UNLESS OTHERWISE STATED. K=1000. M MEGHM.
ALL CAPACITANCE IN MICROMICROFARADS. 100 VOLTS MIN. AND ± 20% TOLERANCE UNLESS OTHERWISE STATED. GMV=GUARANTEED MIN. VALVE.
FM TUNING RANGE FROM 88MC TO 108MC. AM TUNING RANGE FROM 540KC TO 1600KC.
FM I.F. FREQUENCY 10.7MC. AM I.F. FREQUENCY 262.5KC.
VOLTAGE MEASUREMENTS:
1. ALL DC VOLTAGES MEASURED WITH A 20,000 OHM/VOLT METER. NO SIGNAL INPUT.
2. ALL AC VOLTAGES MEASURED WITH AN AC V.T.V.M. AT FULL VOLUME. 1 WATT OUTPUT.
3. ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS.
4. ALL VOLTAGES MEASURED WITH + 14.1 VOLTS INPUT WITH NEGATIVE TERMINAL GROUNDED,

FIG. 3—Comet Model F4TBE Radio Schematic

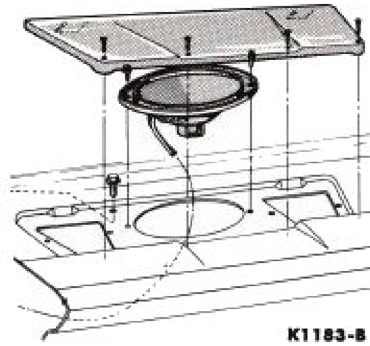


FIG. 4—Radio Speaker Mounting

position on the antenna and install the antenna retaining nut. Torque to specifications.

5. Pull the antenna lead through the opening and route the lead over the glove box and connect the lead to the radio.

INTERFERENCE SUPPRESSION

Interference suppression items are shown in Fig. 5. Both the Falcon and the Comet use a generator condenser, a regulator condenser, and wheel static collectors. A constant voltage regulator choke and a hood bonding clip are used on the Comet only.

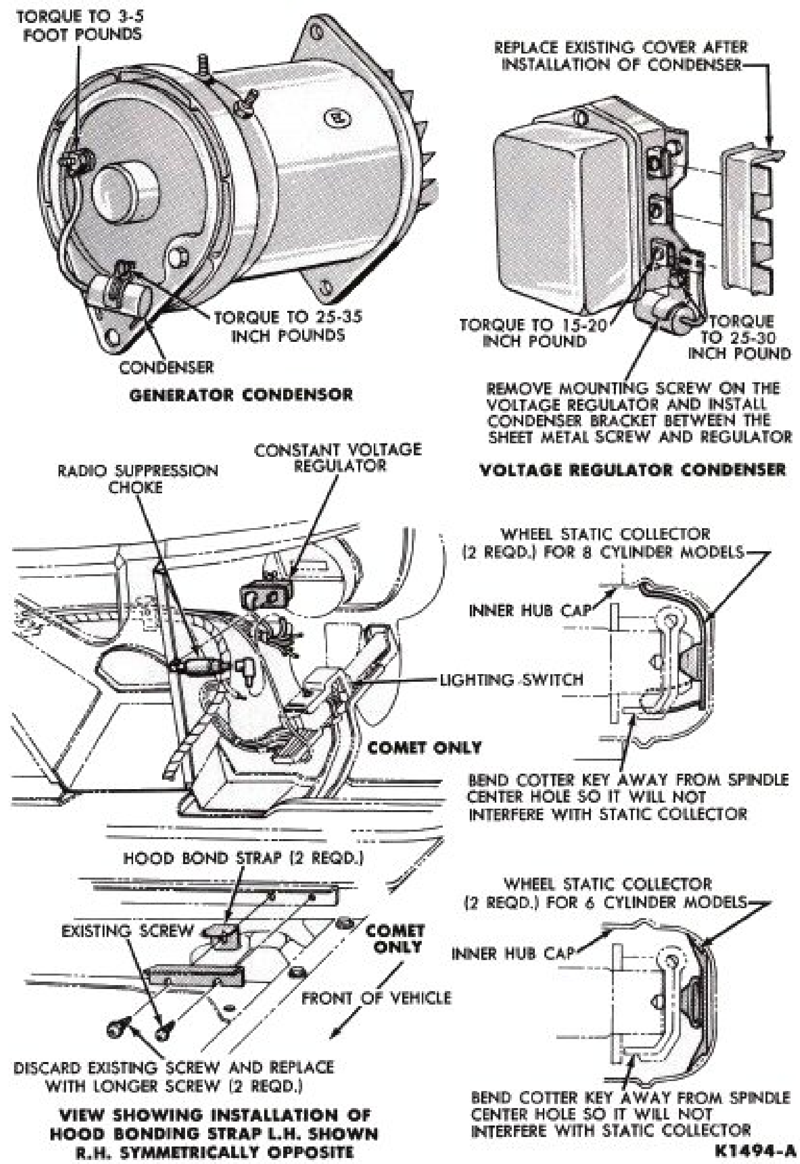


FIG. 5—Radio Interference Suppression

PART 16-5 SPECIFICATIONS

Blower Motor Current Draw at 12 Volts	Heater	Air Conditioner
High Speed	6-8 Amps	6.5-7.5 Amps
Medium Speed	4-6 Amps	4.5-5.5 Amps
Low Speed	2-4 Amps	3.0-4.0 Amps
CIRCUIT PROTECTION	SFE 14 Fuse	3AG 15 Fuse
Location	Fuse Panel	In Line

RADIO CURRENT DRAW

1 Amp Max. at 12 Volts

MOUNTING TORQUE TORQUE (IN-LBS)

Radio to Instrument Panel	25-35
Support Bracket Screw and Nut	25-35
Antenna Mounting Nut	15

AIR CONDITIONER COMPRESSOR

Location	Torque (ft-lbs.) York
Cylinder Head	14-18
Front Seal Plate	13-17
Service Valves (Rotolock)	35-Max.
Mounting Bolts	14-17
Oil Filler Plug	18-22
Clutch Mounting Bolt	15-22
Base Plate	7-11
Back Plate	7-10

Oil Capacity — ¾ inch (10 ounces)
Use Suniso #5, or Capella E

DRIVEN BELT TENSION

Between Fan Pulley and Air Conditioner Compressor

All Engines ....New 120-150
Used* 90-120

*Belt operated for a minimum of 10 minutes is considered a used belt.

BODY, DOORS AND WINDOWS

GROUP 17

PART 17-1 GENERAL BODY SERVICE

1 DIAGNOSIS AND TESTING

DUST AND WATER LEAKS

Sealer locations should be considered when checking for dust or water leaks. The forward motion of the car creates a slight vacuum within the body, particularly if a window or ventilator is partially open. Any unsealed small opening in the lower section of the body will permit air to be drawn into the body. If dust is present in the air, it will follow any path taken by the air from the point of entry into the passenger and luggage compartments. Opening the ventilator air ducts will equalize these pressures. Dust accumulates in the rocker panel, and may eventually work its way to the kick-up or the rear body pillar, and follow the contour of the wheelhouse into the luggage compartment.

To eliminate dust leakage, determine the exact point at which the dust enters. The point of entry is often deceptive in that the dust may enter at one point, then follow the passages formed by interior trim to another point.

Under certain conditions, water can enter the body at any point where dust can enter. Any consideration of water leakage must take into account all points covered under dust leaks.

To determine the exact location of a dust leak, remove the following trim from the car:

1. Cowl trim panel.

2. Quarter trim panel.

3. Rear seat back and seat cushion

4. Luggage compartment floor mats, spare wheel, and side trim panel.

5. Center pillar trim on 4-door models.

6. Scuff plates.

After removing the trim, the location of most leaks will be readily evident. The entrance of dust is usually indicated by a pointed shaft of dust or silt. Seal these leaks, and road test the car on a dusty road to make sure all leaks are sealed.

After the road test, check for indications of a dust pattern around the door openings, cowl panel, lower part of the quarter panel, and in the luggage compartment.

Sometimes leaks can be located by putting bright lights under the car, with the above components removed, and checking the interior of the body joints and weld lines. Tht light will show through where leaks exist.

2 COMMON ADJUSTMENTS AND REPAIRS

TYPES OF SEALER AND APPLICATION

The all-purpose sealers described below have been selected for service use. The method and points of application are given under each sealer type. For illustrations refer to Figs. 1 and 2.

CAULKING CORD AB19560-A

This sealer has a plastic base with an asbestos filler, is heavy bodied, and is commonly known as "perma-gum." It is used on spotweld holes, around moulding clips, or between two surfaces not properly sealed by a gasket. Apply the sealer with a putty knife.

TRIM CEMENT C2AZ-19C525-A

This cement is recommended for instrument panel safety cover and body panel plastic water shield installation. It is also useful for repair or replacement of other vinyl and rubber trim.

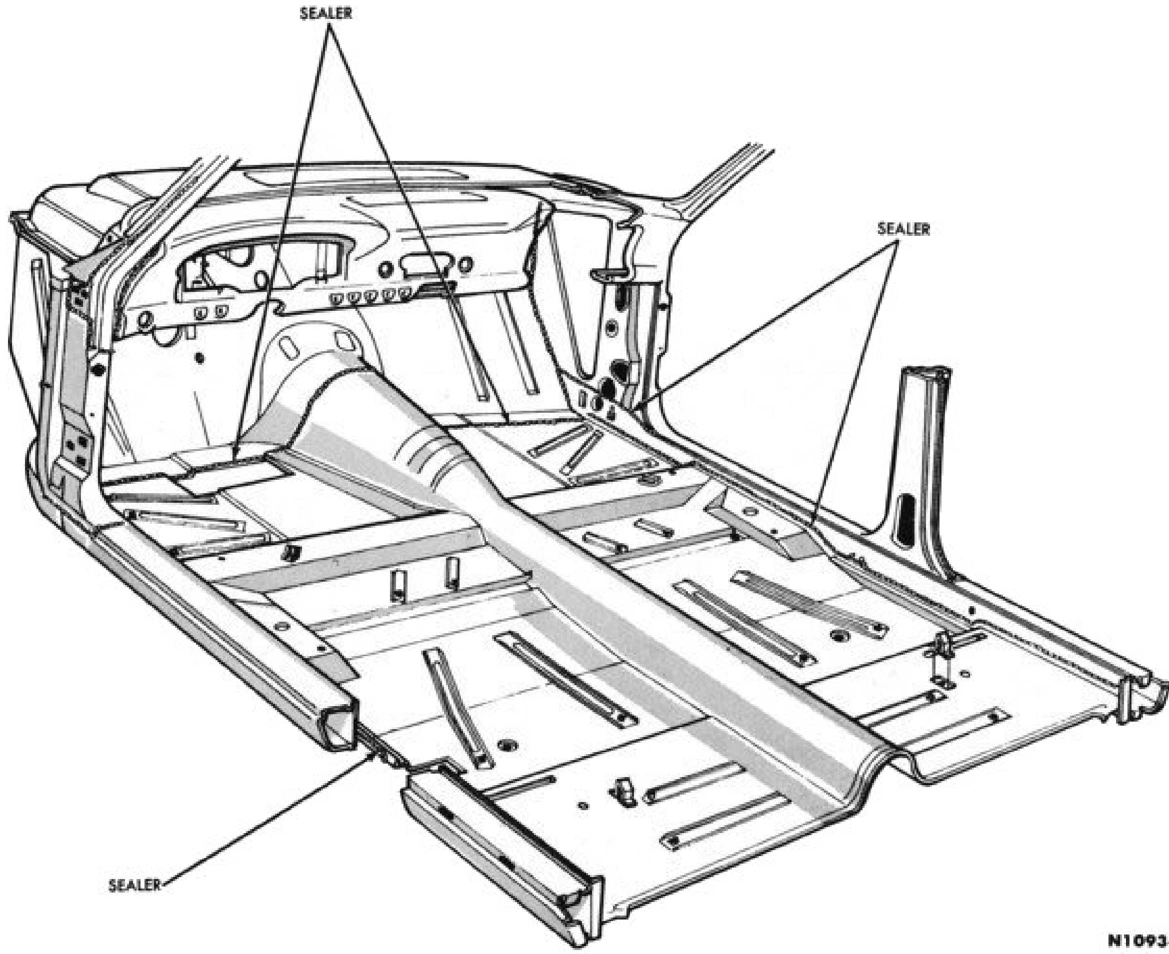


FIG. 1—Front Floor Cowl Side & Instrument Panel Sealer Application

RUBBER CEMENT 8A-19552-B

This quick-drying, strong adhesive material is designed to hold weatherstripping on doors, bodies, deck lids, cowl ventilators, and the surrounding metal. Windows and windshields which are set in rubber can be effectively sealed against leakage by flowing cement into the affected areas.

Clean all grease, dirt, and old sealer from the surfaces to be cemented. For best results, apply a medium coat of cement to both surfaces, allow it to dry until tacky, and press both surfaces firmly together.

SILICON LUBRICANT COAZ-19553-A (JELLY) AND COAZ-19553-C (SPRAY)

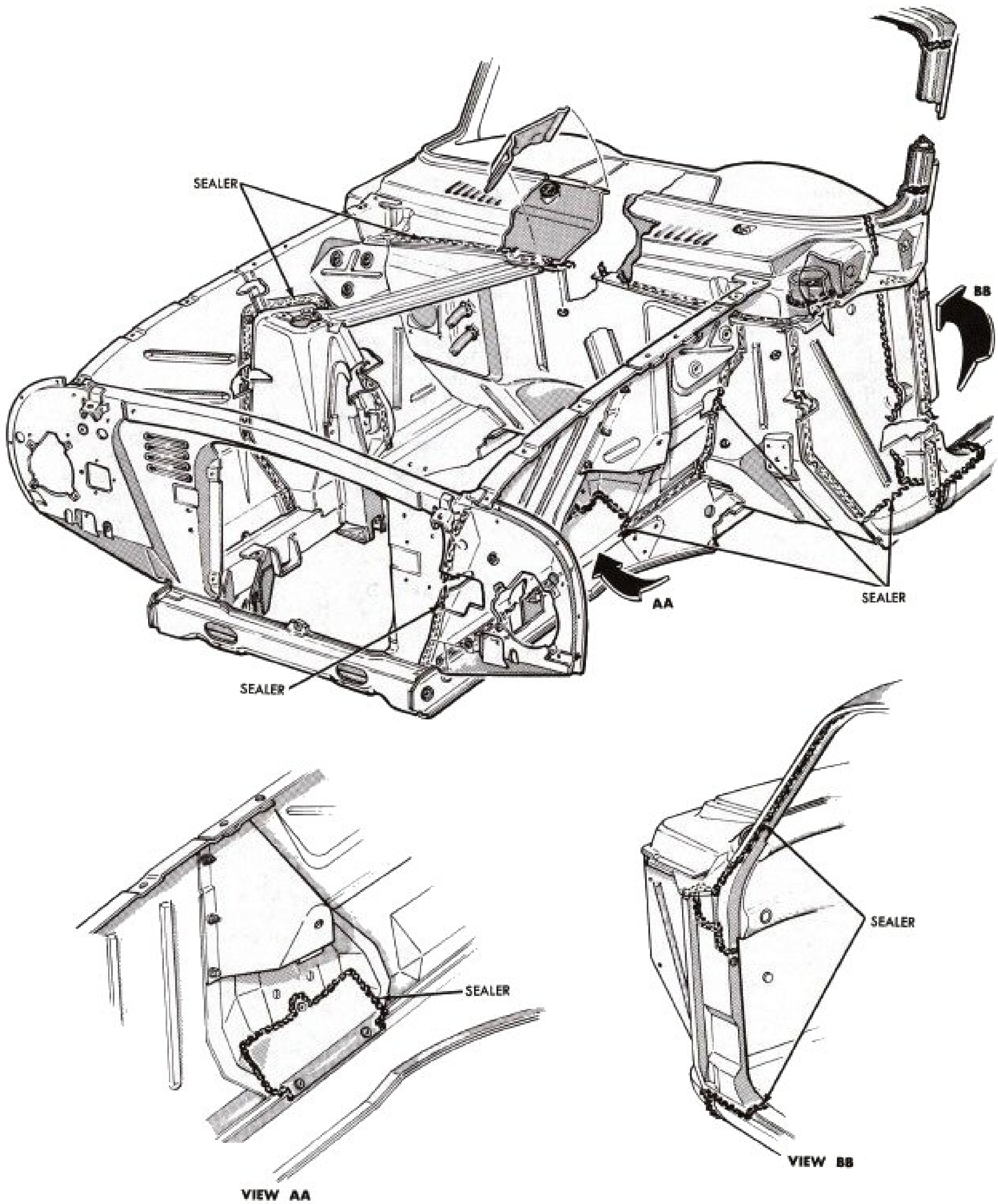
This lubricant is to be used on the door window weatherstrips. It is recommended that silicone lubricant be applied to the upper weatherstrips at every regular lubrication period. Its use makes the doors easier to close, avoids weatherstrip squeaks, retards excess weatherstrip wear from chafing between the door glass upper frame and the weatherstrip, and helps to retain door window alignment by reducing friction between the glass frame and rubber weatherstrip.

BODY ALIGNMENT

Servicing the unitized body should not present any unusual difficulties or necessitate additional equipment other than that required for the conventional frame and body repair. The application of heat and the use of heavy-duty jacks must be carefully controlled because of the difference in the gauge of the metal in the sub-frame of a unitized body and the stress points developed in a single welded unit construction. It is possible to pull damaged areas back into alignment with the use of light-weight jacks and hydraulic equipment without heating the metal.

Rough out badly damaged areas before taking measurements for squaring up a body. If necessary, remove the glass from the damaged area to prevent damage. In severe cases reinforcement brackets and other inner construction may have to be removed or cut to permit restoration of the outer shell and pillars without excessive strain on the parts. Straighten, install, and secure all such parts in place before attempting to align the body.

In cases of severe or sharp bends, it may be necessary to use heat. Any attempt to cold-straighten a severely bent bracket may cause ruptures of the welds and may also



N1094-A

FIG. 2—Radiator, Cowl and Fender Apron Sealer Application

cause cracks in the bent part. Never heat the area more than a dull red.

CHECKING BODY FOR MISALIGNMENT

To align or square up a body, take two opposite diagonal measurements between pillars. Use a measuring tram for these measurements. Take the measurements between reference points such as crease lines or weld joints which are diagonally opposite each other on the two pillars being measured. Since all measurements should be made from the bare metal, remove all interior trim from the checking points.

In some cases, it is difficult to obtain proper body alignment when repairing a body that is damaged on both sides. In these cases, horizontal and vertical measurements can be taken from a body of the same body style. Once these basic dimensions are taken and established on the damaged body, alignment can be made by diagonal measurements taken from points on the two pillars.

Do not attempt to correct any serious misalignment with one jacking operation. This is particularly true if other sections of the body also require aligning. Align each section proportionately until the proper dimensions are obtained.

Door openings are checked in the same manner as the body. Horizontal, vertical, and diagonal checking points are established on all four sides of the door opening that is being measured.

CHECKING UNDERBODY FOR MISALIGNMENT

The dimensions of the underbody must be restored in the repair of major body damage, to provide correct front and rear wheel geometry (Figs. 3 and 4). All the dimensions are detailed to the center line of existing holes in the underbody assembly. Once the frame and suspension members are aligned, the balance of the repair can be performed.

PAINT DAMAGES AND REPAIR

PAINT REPAIRS ON GALVANIZED METALS

If for any reason it becomes necessary to perform paint repairs on galvanized rocker panels or any other galvanized steel surfaces, care must be exercised in preparing the bare galvanized surface to properly accept paint. The best possible paint products must be used to insure satisfactory adhesion to the metal and to give a good color match with acceptable durability.

Metal Preparation For Galvanized Steel.

1. Strip, sand off or otherwise remove all paint from the affected galvanized steel panel.

2. Wire-brush or steel-wool the entire metal surface and remove all grease or oil by wiping with a clean solvent.

3. Wipe the panel using a clean cloth or sponge with Lithoform #2. The work should be kept completely wet for at least three minutes and the metal should be thoroughly etched. If any bright metal remains the treatment should be repeated.

4. Rinse the area with clean water and blow off with compressed air.

5. The dried surface must be primed immediately. Then succeeding coats and color as required must be applied according to the vendor's directions.

PAINT REFINISHING—ALKYD ENAMELS

The recommended repair procedures for alkyd enamels are as follows:

1. Remove all name scripts, wipers, etc., which are more difficult to mask than to remove. Mouldings, etc., which are not removed should be covered with masking tape and paper.

2. Before sanding the surface to be painted, remove all traces of wax, polish and grease with a good wax and grease remover (M-3721).

3. Scuff sand the area to be painted with #320 paper (wet).

4. Feather edge the damaged areas to assure proper blending of paint between panels (where no body seams allow for a clean break point).

5. Wash off the area to be painted with silicone remover (DL60-3721-A) or good enamel thinner. Before the solution has a chance to dry, wipe off with clean dry rags. Change rags frequently.

6. Blow off the panel with compressed air to remove all traces of dust, sanding residue or moisture.

7. Move the car into the spray booth. All of the car except the immediate area to be refinished should be covered to protect from overspray.

8. Wipe the area to be painted with a tack rag to pick up final traces of dust or lint.

9. Spray two full finishing coats of paint. Follow the supplier's instructions on drying time between coats.

If both the color coat and prime coat are damaged, the following additional steps should be applied:

1. Remove the paint in the damaged area to bare metal if necessary for the proper feather edge.

2. Apply two coats of primer surfacer and proceed with the procedures beginning with step 3.

PAINT DEFECTS AND REPAIR PROCEDURES

Listed here are some of the abnormal paint conditions that may be encountered. It is very important to identify the paint condition correctly so that the proper repair procedure may be followed. For each of the following paint conditions described, the recommended repair procedure will be indicated.

Blistering. Blistering is the formation of bubbles or pin points on the surface of the finished work (Figs. 5 and 6). Unless inspected by a magnifying glass, this condition is very hard to identify. In some instances, this complaint may be confused with dirt in the paint. To verify blistering, prick the suspected areas and note whether a hole exists under the bubble. This condition is caused by rust, moisture, or oil between the coats, metal not properly cleaned, or uneven temperatures between the metal and the paint being sprayed.

ALKYD ENAMEL—Repair by repainting. (Color coat).

Checking. "Line checking" has the appearance of thin, straight lines criss-crossing each other (Fig. 7). These lines may be from ½-4 inches or longer, increasing in length as the finish ages.

ALKYD ENAMEL – Refinish panels (Color coat—primer if damaged).

Chipping and Stone Bruises. Chipping occurs when the surface of the finish coat of paint has been broken by a sharp blow, and small particles of paint have flaked off (Fig. 8). Frequently, stone bruises result in chipping (Fig. 9).

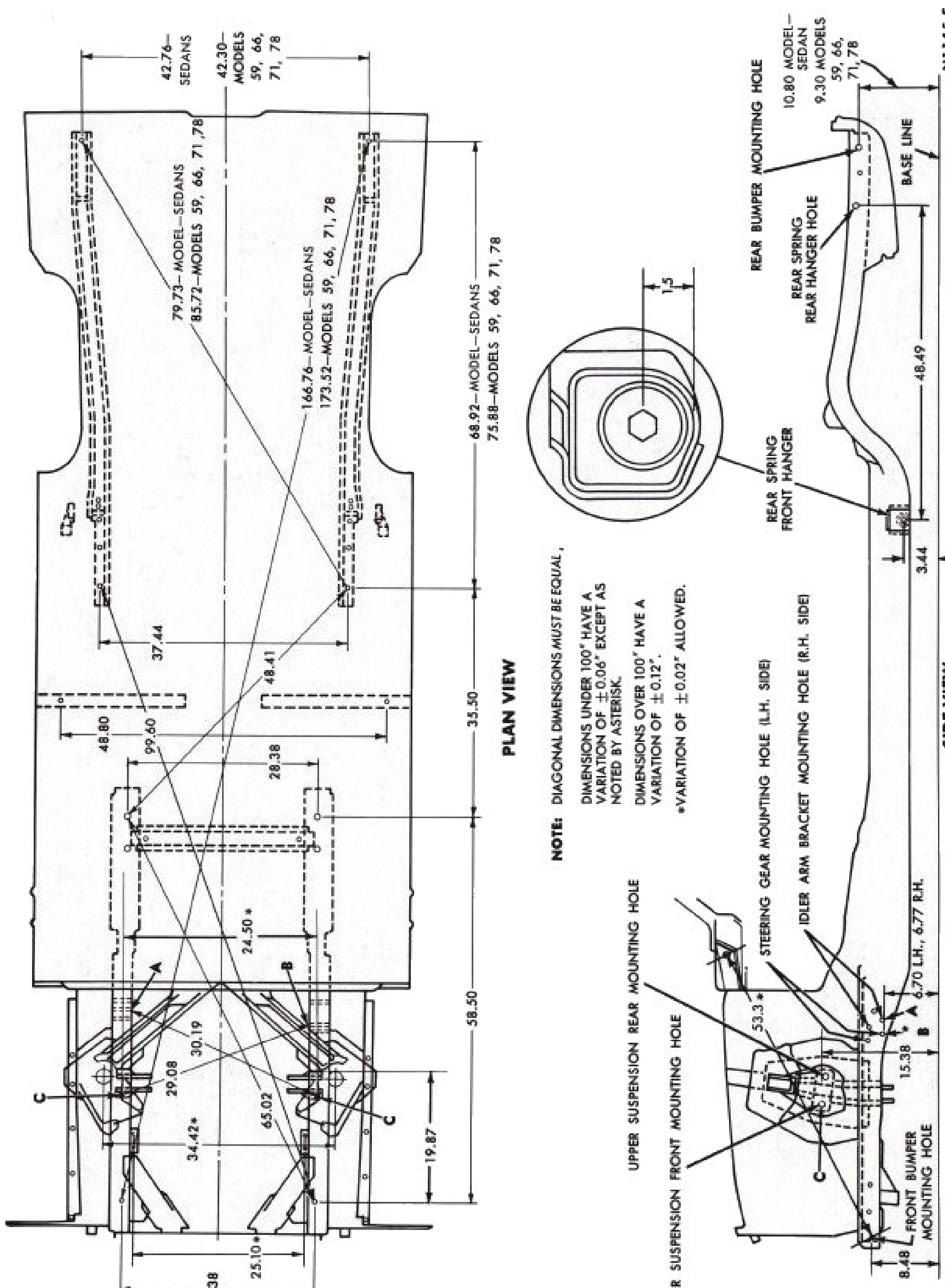


FIG. 3—Underbody Dimensions—Falcon

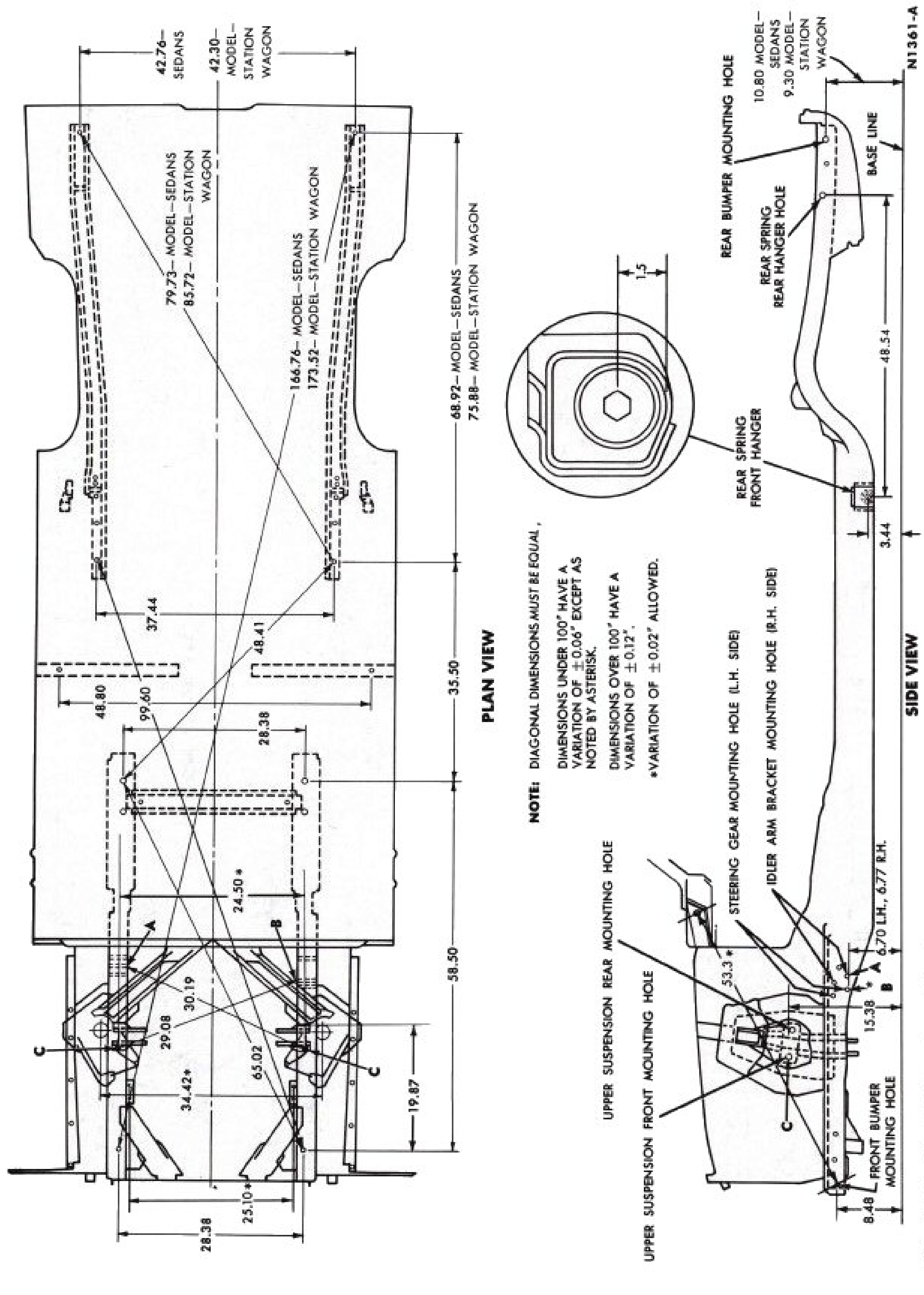


FIG. 4—Underbody Dimensions—Comet

FIG. 5—Random Blisters

FIG. 6—Pattern Blisters

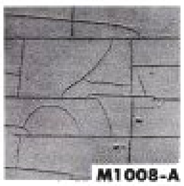


FIG. 7—Line Checking

FIG. 8—Chipping

FIG. 9—Bruises

ALKYD ENAMEL – Refinish panels. (Prime it to bare metal).

Cracking. Cracking is evidenced by the paint curling. Frequently, cracking starts at the edge of the panel (Fig. 10). This is caused by poor mixing of paint, or by temperature changes during the various painting stages.

ALKYD ENAMEL – Refinish panel (Prime if both color and primer cracking).

Crow Footing. Crow footing may be described as small lines branching off from a point in all directions and

FIG. 10—Cracking

giving the appearance of a crow's foot. (Fig. 11). Crow footing is usually caused by spraying a second coat before the first coat is dry, by spraying an excessively thick coat, or by thinners which evaporate too fast.

ALKYD ENAMEL – Repaint panel (Color coat).

Dirt in Paint. Patches where dirt appears (Fig. 12) are sometimes confused with blistering. To verify the condition, prick the suspected areas, and note whether there is foreign material under the surfaces.

ALKYD ENAMEL—Sand smooth and refinish. (Color coat).

Mildew. Mildew growth is most commonly found in a very dark gray or black color, and occurs along radial lines (Fig. 13).

ALKYD ENAMEL—Repair by polishing.

Off-Color. The term off-color is

FIG. 11—Crowfooting

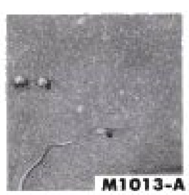


FIG. 12—Dirt in Paint

FIG. 13—Mildew

applied to adjacent areas on which the colors do not match (Fig. 14). It may also appear when making spot repairs.

ALKYD ENAMEL—Refinish panel (Color coat).

Orange Peel. Orange peel is a term used to describe an uneven, mottled appearance on the paint surface (Fig. 15). This is usually caused by improper thining of the paint.

ALKYD ENAMEL – Repair by polishing.

Overspray. Overspray is evidenced by a rough, dull finish in the area surrounding the paint repair (Fig. 16).

ALKYD ENAMEL—Lightly sand out the overspray and apply a properly thinned finish coat if repairs cannot be made by polishing.

Peeling. Peeling occurs when large areas of the finish or primer coat separate from the metal or prime coat (Fig. 17). This is usually caused by wax, grease, rust, or oil under the paint. Do not confuse with orange peel.

ALKYD ENAMEL – Refinish panel (Prime as necessary).

Pits and Craters. Pits and craters may be identified by the appearance of small round depressions in the paint (Figs. 18 and 19). These may be caused by not allowing the first coat to dry sufficiently before applying the second coat or from failure to remove silicone polishes before repainting.

ALKYD ENAMEL – Refinish panels (Color coat).

FIG. 14—Off Color

FIG. 15—Orange Peel

FIG. 16—Overspray

FIG. 17—Peeling

FIG. 18—Pits

FIG. 19—Craters

FIG. 20—Primer Shows

FIG. 21—Runs and Sags

FIG. 22—Wrinkles

FIG. 23—Scratches

FIG. 24—Water Spotting

FIG. 25—Industrial Fall-Out

Primer Shows. The primer will show through the finish coat as a result of an excessively thin color coat, or application of the color coat before the surface is dry (Fig. 20).

ALKYD ENAMEL – Refinish panel (Color coat).

Runs, Sags and Wrinkles. The uneven collections of paint on the finished surface are referred to as runs or sags (Fig. 21). The collections may appear in the form of tear drops or sagging lines. Usually these lines are quite soft and sometimes they may be wrinkled (Fig. 22). This is usually caused by over-application of paint or hesitation in the stroke of the gun.

ALKYD ENAMEL – Refinish panels.

Scratches. Scratches are thin marks or tears that may partially or completely penetrate the surface of the finish coat of paint (Fig. 23).

ALKYD ENAMEL—Refinish panels if unable to polish out.

Spot Discoloration. This is evidenced by brown spots or stains on the surfaces. Stains or spots can be caused by road tar, acid or alkali-bearing water from the streets.

ALKYD ENAMEL—Use polish repair procedure. Refinish panel if not effective (Color coat).

Water Spotting. Water spotting is evidenced by a milky pattern where water drops have fallen (Fig. 24).

ALKYD ENAMEL – Use polish repair procedure. Refinish panel if not effective (Color coat).

Industrial Fall-Out. Industrial fall-out is the result of particles being exhausted into the air by the various processes of heavy industry, or in areas where there is a concentration of industry.

Industrial fall-out particles appear as tiny rust-colored dots on the paint film, and the surface will feel rough to the touch (Fig. 25). Some of the particles have excellent adhesion and are difficult to remove. However, the following procedure has proven effective in the removal of this fall-out:

1. First wash the car with car wash compound (COAA-19B521-A) to remove loose soil. Rinse well and examine painted surfaces for iron base fall-out particles. If there is a significant quantity of fall-out not removed by ordinary washing, the oxalic treatment should then be used. All cracks, ledges, grooves, etc., where fall-out has accumulated should be cleaned by wiping or by air blow-off.

2. Dissolve six to eight ounces of oxalic acid (dry) in one gallon of warm water and add one or two tablespoonsful of a non-alkaline detergent such as car wash compound (C0AA-19B521-A).

Neutral detergents are permissible, but all alkaline compounds should be avoided. This acid detergent solution must be prepared and kept in a clean NON-METALLIC container.

Apply this solution liberally to all affected surfaces of the car with a large sponge. Use a broad wiping stroke and keep the work completely wet for about 15 minutes, or until the operator can no longer feel any surface roughness or isolated gritty particles with bare or gloved finger tip. If this is not done thoroughly, rust staining may soon redevelop. Again, it is most important that the work be kept wet, since a dry acid residue is not active in loosening fallout. Be sure that the entire acid

cleaning procedure is performed in a sheltered area so that the work will be kept as cool as possible, to prevent rapid evaporation of water and consequent surface drying. DO NOT WORK IN THE SUN. Even a strong breeze makes it difficult to keep the job wet over a large area.

3. Rinse the job with clear water. This must be done very thoroughly to prevent possible corrosion.

No traces of acid should be left on any surface. Bright trim parts, particularly anodized aluminum and stainless steel, may be stained by prolonged contact with the cleaning solution. Even painted areas can be spotted by prolonged exposure. It is also important to keep the oxalic acid cleaner solution from leaking inside the car because some fabrics might be bleached or discolored by the solution.

If the fallout is not completely removed or is deeply imbedded in the paint film, cleaning with the acid detergent mixture must be repeated. It is helpful sometimes to briskly rub the work with a mixture of equal parts of the oxalic acid cleaner and FoMoCo cleaner wax polish (8A-19519-A) using a piece of heavy toweling. Again thorough water rinsing is extremely important.

Sometimes small black spots remain after the oxalic cleaning has removed all iron based fall-out. Such deposits might be asphaltic or they might be over-spray. These can usually be removed by rubbing vigorously with a cloth saturated with a mixture of kerosene and Actusol (about 5 parts of kerosene to 1 part of actusol). Any residue of this solvent mixture may be readily flushed off with water.

Organic Fall-Out. Organic fall-out may result from parking cars under trees or from the air under certain atmospheric conditions (Fig. 26).

ALKYD ENAMEL — Refinish damaged panels (Color coat and primer).

INTERIOR PAINT REPAIRS

The proper matching of colors can be obtained if the following procedures are carefully adhered to:

FIG. 26—Organic Fall-Out

1. Clean the surface to be painted with wax and silicone remover.

2. Feather-edge the damaged area with #400 grit wet or dry sandpaper. (Prime all areas of bare metal with M-6J-12S Primer).

3. Mix the paint following the instructions on the can and spray several light coats.

Allow the paint to become tacky between coats.

4. Spray the entire area sparingly with B7A-645-S Lacquer Leveler which will blend the repaired area with the existing painted surfaces.

3 CLEANING AND INSPECTION

FLOOR PAN PLUGS AND GROMMETS

The floor pan plugs seal the various body bolt access holes. If any plugs are missing or improperly installed, a dust or water leak may result. This also applies to the grommets used on the dash panel. When dust or water leaks are evident, these plugs and grommets should be checked for proper installation.

DRAIN HOLES

Drain holes (Fig. 27), located on the underside of each rocker panel, quarter panel, and door, should be cleared periodically.

BODY MAINTENANCE

Regular body maintenance preserves the car's appearance and reduces the cost of maintenance during the life of the car. The following steps are suggested as a guide for regular body maintenance.

1. Vacuum the interior thoroughly and wash the car.

2. Check all openings for water leaks, and seal where necessary.

3. Cement all loose weatherstrips which are still usable.

4. Replace all door and deck lid weatherstrips which are unfit for service.

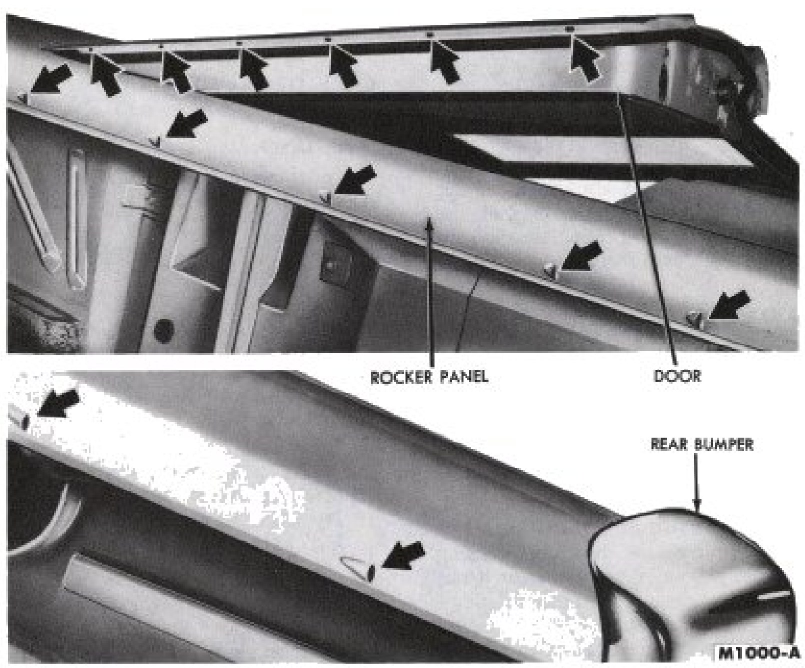


FIG. 27—Drain Holes

5. Apply silicone lubricant to the weatherstripping.

6. Replace all cracked, fogged, or chipped glass.

7. Align the hood, doors, and deck lid if necessary.

8. Inspect the windshield wiper blades and replace if necessary.

9. Tighten sill plate and garnish moulding screws.

10. Clean the seats, door trim panels, and headlining.

11. Touch up or paint chipped or scratched areas.

12. Drain holes located on the underside of each rocker panel, quarter panel, and door, should be cleared periodically.

RATTLE ELIMINATION

Most rattles are caused by a loose bolt or screw. Foreign objects such as nuts, bolts, or small pieces of body deadener in the door wells, pillars and quarter panels are often the source of rattles. Door wells can be checked by carefully striking the underside of the door with a rubber mallet. The impact made by the mallet will indicate if loose objects are in the door well.

In the event that tightening the bolts and screws, located on such assemblies as the doors, hood, and deck lid does not eliminate the rattles, the trouble is probably caused by misalignment. If this is the case, follow the adjustment and alignment procedures for these assemblies.

Rattles and squeaks are sometimes caused by weatherstripping and anti-squeak material that has slipped out of position. Apply additional cement or other adhesive, and install the material in the proper location to eliminate this difficulty.

EXTERIOR CLEANING

The outside finish should be frequently washed. Never wipe the painted surfaces with a dry cloth. Dusting the finish when it is dry tends to rub the dust and dirt into the baked enamel, and leaves a sandpaper effect on the surface. To keep the finish bright and attractive and eliminate the necessity of using polish, wash the car whenever it has accumulated a moderate amount of dirt and road salt.

The bright metal parts of the car require no special care. Periodic cleaning will preserve the beauty and life of these finishes. Wash with clear water or if the parts are very dirty use FoMoCo COAA-19B521-A compound. Using a clean soft cloth or a sponge and water, rinse and wipe the parts dry. FoMoCo Chrome Cleaner may be used sparingly to remove rust or salt corrosion from chrome plated parts. Do not scour aluminum or chrome finished parts with steel wool or polish them with products containing abrasives. A FoMoCo Polish will provide excellent protection for all bright metal parts.

INTERIOR CLEANING

Use a vacuum cleaner to remove dust and dirt from the upholstery or floor covering. Vinyl and woven plastic trim that is dusty can usually be cleaned with a damp cloth. **Do not use cleaning materials containing kerosene, naptha, toluol, xylol 10°, lacquer thinners, cellulose acetate, butyl cellosolve, carbon tetrachloride, body polish, battery acid, anti-freeze, gasoline, motor oils or other type lubricants.**

Approved cleaners B8A-19523 A or B, B5A-19525A, COAZ-19526 A or B, (soft trim cleaners), BAF-19521-A (leather and vinyl upholstery cleaner), and CIAZ-19C507-A (convertible back window cleaner) are available for service. Instructions for the use of these cleaners are indicated with their containers.

CARE OF WOOD GRAIN PANELING

WASHING

Never wipe the panels or trim rails with a dry cloth. This method of cleaning tends to rub dust particles into the finished surface and leave fine scratches. Flush off all loose dirt and other elements, and wipe the body panels and rails with a sponge and plenty of cold water. If desired, a mild soap may be used. Rinse thoroughly with clear water and wipe dry.

GLASS FIBER TRIM RAIL REMOVAL AND INSTALLATION

The glass fiber trim rails are serviced with the wood-grain already applied. To remove the body side trim rails, remove the cap over each trim rail screw to gain access to the screws. Remove the screws and the trim rail assembly.

When installing the body side trim rail, sealer (AB-19560-A) around each mounting hole. Install the cap retainer, screw and cap.

APPLICATION OF WOOD-GRAIN TRANSFERS

Wood grain transfers are available for application to the panels. The materials necessary to apply the transfers are a bonding coat (M-4584), 20% transfer solution of M-5412-A, and clear spar varnish.

If the surface on which the transfer is to be applied is damaged, repair and metal finish first.

1. Mask off the area where the transfer is to be applied.

2. Prime-coat all bare metal areas, and wet-sand.

3. Spray the surface with transfer bonding coat (M-4584). This coat is the binder for the transfer adhesive.

4. Allow the binding coat to air-dry for one hour, or heat-dry (160°F) for 20 minutes.

5. Lightly wet-sand the binding coat, and wipe it dry.

6. Make a paper template of the damaged area, and cut the new transfer to size, using the template as a guide. Leave about ½ inch of extra material around the edge of the transfer to allow for matching and trimming.

7. Mix a solution of 20% transfer solution M-5412-A and 80% water. This solution permits shifting of the transfer after it has been applied, so that the graining can be matched. **Try a sample of the transfer and solution on an old piece of metal or fender. If the transfer cannot be pulled off after two minutes, the solution is too strong and must be diluted with more water.**

8. Soak the transfer in lukewarm water for one minute to loosen the paper backing. **Do not remove the backing until the transfer is applied.**

9. Using a cheese cloth pad, apply a 20% M-5412-A transfer solution to the panel. **Any excess solution that runs down on adjacent panels must be wiped off immediately.**

10. Place the wet transfer on the panel, paper side out. Adjust the transfer to match the graining on adjoining panels, and carefully remove the paper backing.

11. Sponge the transfer with clean

water to remove all traces of the paper backing adhesive.

12. Remove all air bubbles and wrinkles with a squeegee.

13. Wash the transfer with clear water and dry with a chamois.

14. Pierce any blisters or small air bubbles as they appear, and press down the area with a finger to remove the air and excess solution.

15. Allow the panel to air-dry for one hour, or heat dry (160°F.) for 20 minutes.

16. When the panel is dry, spray two coats of clear spar varnish over the transfer. **Do not use clear lacquer or shellac.**

4 HOISTING VEHICLE

The unitized body-frame construction requires special precautions and procedures when the car is jacked up or hoisted. In some cases, special hoist adapters must be used as recommended by specific hoist manufacturers.

DRIVE-ON TYPE HOIST

To prevent possible damages to the underbody, do not drive the car onto the drive-on type hoist without first checking for possible interference between the upright flanges of the hoist rails and the underbody. Should there be interference, the hoist flanges should be modified as necessary and/or the approach ramps built up to provide the needed clearance.

RAIL TYPE—FREE WHEELING HOIST

FRONT

The front adapters or hoist plates must be carefully positioned in contact with the lower suspension arms to assure safe, secure lifting.

REAR

The hoist adapters must be positioned carefully under the rear axle to prevent damage to the shock absorbers when the car is raised. The hoist rails should be raised slowly and the position of the adapters checked.

FORK LIFT—TWIN POST HOIST

FRONT

To assure safe hoisting, the front post adapters must be positioned carefully to contact the center of the lower suspension arms.

REAR

To prevent damage to the shock absorbers, the rear forks must contact the axle at points not farther out board than one inch from the circumference welds near the differential housing. Carefully raise the rear post and check the position of the fork.

FRAME CONTACT HOIST

Frame contact hoist adapters are necessary to lift the car. The hoist adapter pads should each cover at least 12 square inches of underbody area. Figs 28 and 29 show recommended contact points.

FLOOR JACK

When a stationary floor jack or a roll jack is to be used, there are several specific recommended points of contact. Either side of the car may be raised at the front by jack contact at the lower arm strut connection. Either side of the front end of the car may also be raised by jack pressure on the front crossmember, or on the crossmember to which the stabilizer is connected.

Either side of the rear end of the car may be raised by jack pressure on the rear crossmember. **Do not put pressure on the fuel tank.**

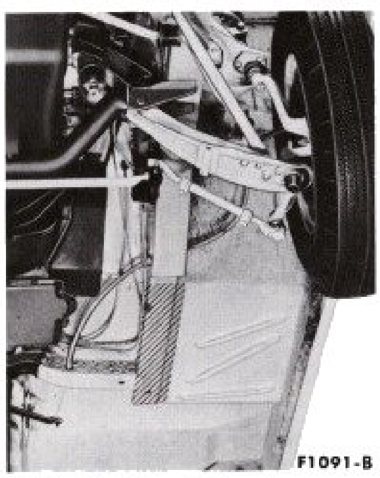


FIG. 28—Front Hoist Contact Area

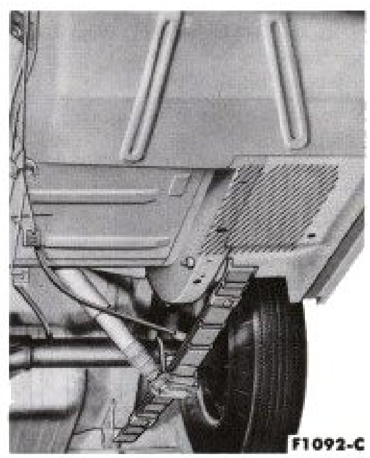


FIG. 29—Rear Hoist Contact Area

PART 17-2 FRONT SHEET METAL, BUMPERS AND EXTERIOR MOULDINGS

1 IN-CAR ADJUSTMENTS AND REPAIRS

HOOD ADJUSTMENTS

The hood is provided with fore and aft, vertical, and side-to-side adjustments (Fig. 1). These directions refer to the position of the hood when it is fully lowered. The elongated bolt slots in the hinge at the hood provide the side-to-side adjustment. The enlarged holes in the hinge at fender apron provide both vertical and fore and aft adjustments.

HOOD LOCK ADJUSTMENT—FALCON

Before adjusting the hood lock mechanism, make certain that the hood is properly aligned. The hood lock (Fig. 2) can be moved fore or aft and side to side to align it with the lock dowel. The safety catch can be adjusted to engage the hood lock catch.

1. Loosen the hood lock attaching bolts (Fig. 2). Move the lock assembly as required to align it with the lock dowel on the hood.

2. Tighten the attaching bolts.

3. Loosen the lock nut on the hood lock dowel and turn the dowel inward to adjust the hood tighter or outward to loosen the adjustment.

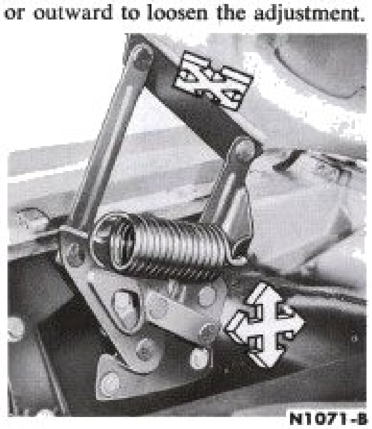


FIG. 1—Hood Hinge Installation

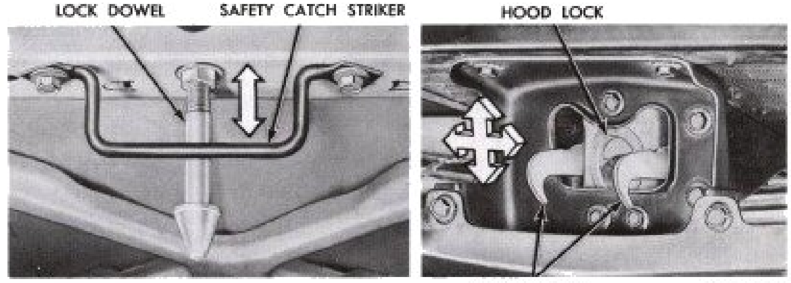


FIG. 2—Hood Lock Mechanism—Falcon

4. The lock dowel is adjusted correctly when the top of the hood is flush with the fenders, when locked.

5. Tighten the dowel lock nut after adjusting the lock dowel.

6. To adjust the safety catch striker, loosen the two attaching screws and position the catch correctly. Tighten the screws and lower the hood to make certain the safety catch striker engages the hood lock safety catch.

HOOD LOCK ADJUSTMENT—COMET

Before adjusting the hood lock mechanism, make certain that the hood is properly aligned. The hood lock (Fig. 3), can be moved from side to side to align it with the lock dowel. The safety catch can be adjusted fore and aft to engage the safety catch striker.

1. Loosen the hood lock attaching bolts (Fig. 3). Move the lock assembly as required to align it with the lock dowel on the radiator grille support.

2. Tighten the attaching bolts.

3. Loosen the lock nut on the hood lock dowel and turn the dowel inward to adjust the hood tighter or outward to loosen the adjustment.

4. The lock dowel is adjusted correctly when the top of the hood is flush with the fenders, when locked.

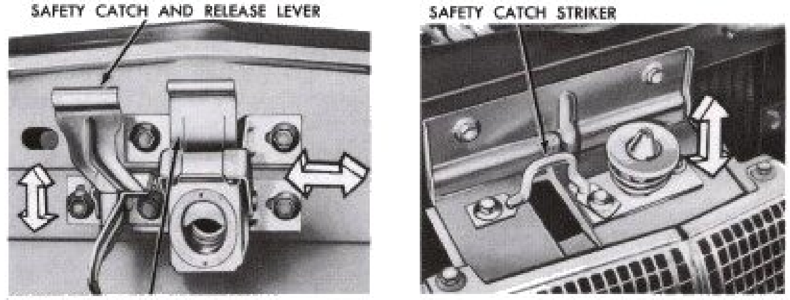


FIG. 3—Hood Lock Mechanism—Comet

5. Tighten the dowel lock nut after adjusting the lock dowel.

6. To adjust the safety catch, loosen the two attaching screws and position the catch correctly. Tighten the screws and lower the hood to make certain the safety catch engages the safety catch striker.

2 REMOVAL AND INSTALLATION

HOOD HINGE

1. Prop the front of the hood in the open position and cover the fender and cowl panel.

2. Remove the hinge-to-hood retaining bolts, the retaining bolts at the fender apron and cowl (Fig. 1), and remove the hinge.

3. Position the hood hinge on the body and install the hinge retaining bolts.

4. Adjust the hood for proper fit.

N1185-C

FIG. 5—Grille Retaining Bolt Locations—Falcon

GRILLE

REMOVAL

1. Raise the hood and remove the headlight rims.

2. Remove the grille retaining bolts and retaining screws and remove the grille assembly (Figs. 4 and 5).

INSTALLATION

1. Position the grille assembly and install the retaining bolts and retaining screws.

2. Install the headlight rims and close the hood.

FENDER

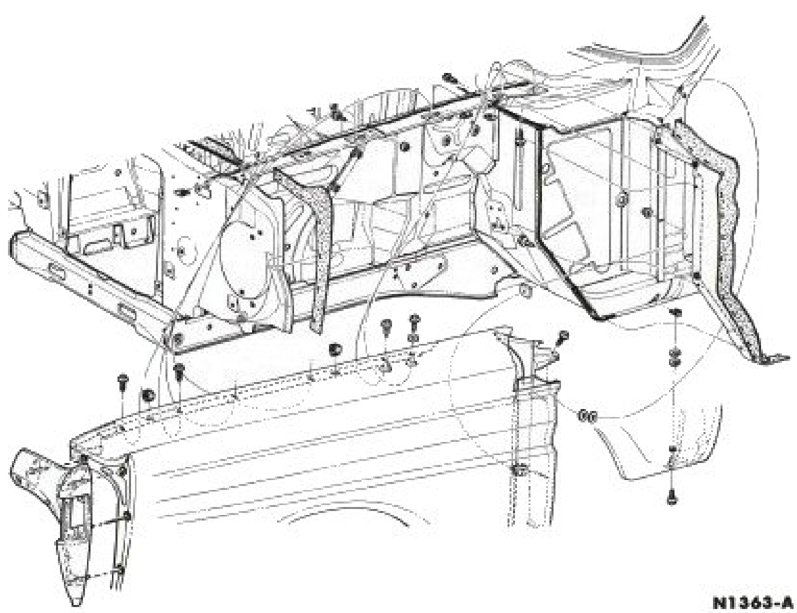
REMOVAL

1. Open the hood and remove the headlamp rim.

2. Disconnect radio antenna lead wire at the radio if so equipped.

3. Remove the kick pad from the cowl on the inside of the car.

4. Remove the nut that secures the fender to the cowl.



N1363-A

FIG. 6—Front Fender Installation—Comet

N1322-B

FIG. 4—Grille Retaining Bolt Locations—Comet

5. Remove the bolt that secures the fender to the rocker panel.

6. Remove the remaining front fender retaining bolts and carefully lift the fender off the apron and the cowl (Figs. 6 and 7).

INSTALLATION

1. Apply a bead of sealer on the upper edge of the fender apron and to all the attaching bolt holes.

2. Carefully position the front fender to the fender apron and cowl.

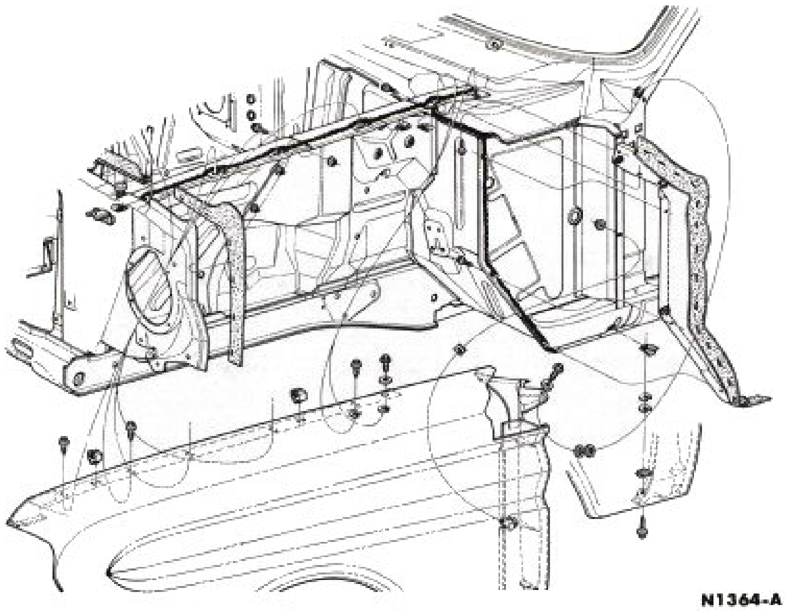


FIG. 7—Front Fender Installation—Falcon

3. Install the fender retaining bolts and nut loosely. Adjust the fender for the best possible alignment and fit, using shims where necessary, and tighten all retaining bolts and nut.

4. Connect the radio antenna lead wire at the radio.

5. Install the cowl side kick pad.

6. Position the headlamp rim and install the retaining screws.

7. Close the hood.

FRONT BUMPER—FALCON

REMOVAL

1. Disconnect the parking lamp wires from their terminals.

2. Remove the license plate.

3. Remove the eight bolts, flat washers and nuts that secure the bumper to the bumper arms and remove the bumper (Fig. 9).

4. Keep all washers (shims) with their respective arms to permit proper alignment of the new bumper.

5. Remove the parking light attaching nuts and retainers and remove the parking lights.

INSTALLATION

1. Secure the parking lights to the bumper bar with the retainers.

2. Position the bumper to the bumper arms and secure using eight bolts, washers, and nuts (Fig. 9).

3. Tighten the bumper - to - arm bolts to 17-23 ft-lbs.

4. Connect the parking lamp wires to their respective terminals.

5. Install the license plate.

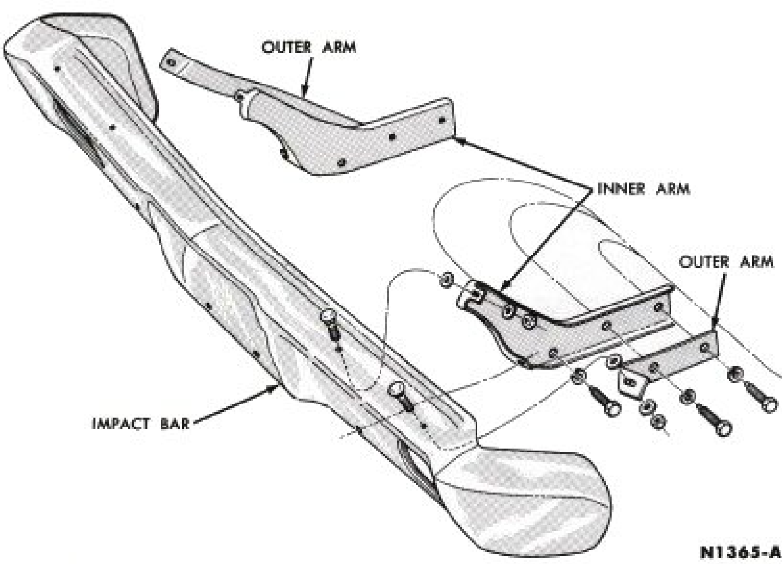


FIG. 8—Front Bumper Installation—Comet

FRONT BUMPER—COMET

REMOVAL

1. Disconnect the parking lamp wires from their terminals.

2. Remove the license plate.

3. Remove the six bolts, flat washers and nuts that secure the bumper to the bumper arms, and remove the bumper (Fig. 8).

4. Keep all washers (shims) with their respective arms to permit proper alignment of the new bumper.

5. Remove the parking light attaching nuts and retainers. Remove the parking lights.

INSTALLATION

1. Secure the parking lights to the bumper bar with the retainers.

2. Position the bumper to the bumper arms and secure using six bolts, washers, and nuts (Fig. 8).

3. Tighten the bumper-to-arm bolts to 17-23 ft-lbs.

4. Connect the parking lamp wires to their respective terminals.

5. Install the license plate.

REAR BUMPER—FALCON-COMET

REMOVAL

1. Remove the two screws retaining the license plate lamp assembly to the rear bumper.

2. Remove the rear license plate.

3. Remove the four bumper arm-to-frame retaining bolts (Fig 10), and remove the bumper assembly.

INSTALLATION

1. Transfer the rear bumper arms and rubber bumper to the new bumper.

2. Position the bumper assembly on the car and install the bumper arm-to-frame retaining bolts.

3. Position the license plate lamp assembly to the bumper and install the retaining bolts.

4. Install the license plate.

EXTERIOR MOULDINGS

Before removing the exterior mouldings, it should be determined by the type of retainer used whether a respective door, quarter or luggage compartment trim panel must first be removed to provide access (Figs. 11 through 20).

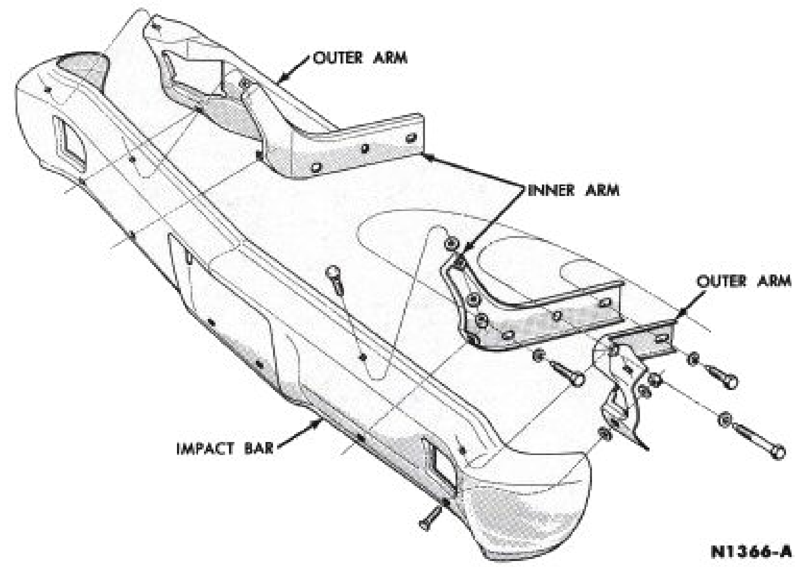


FIG. 9—Front Bumper Installation—Falcon

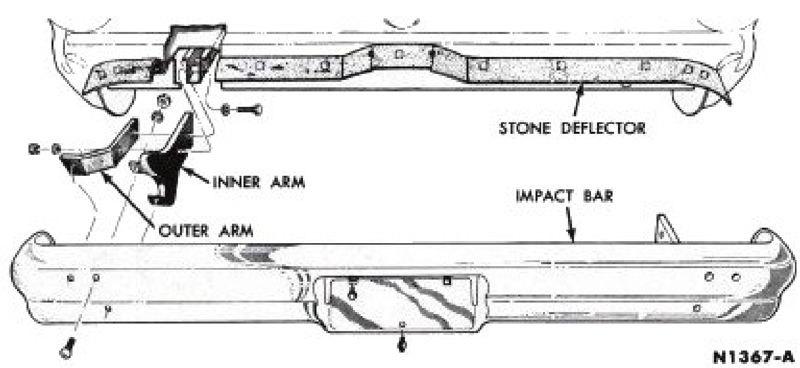


FIG. 10—Rear Bumper Installation—Falcon—Comet

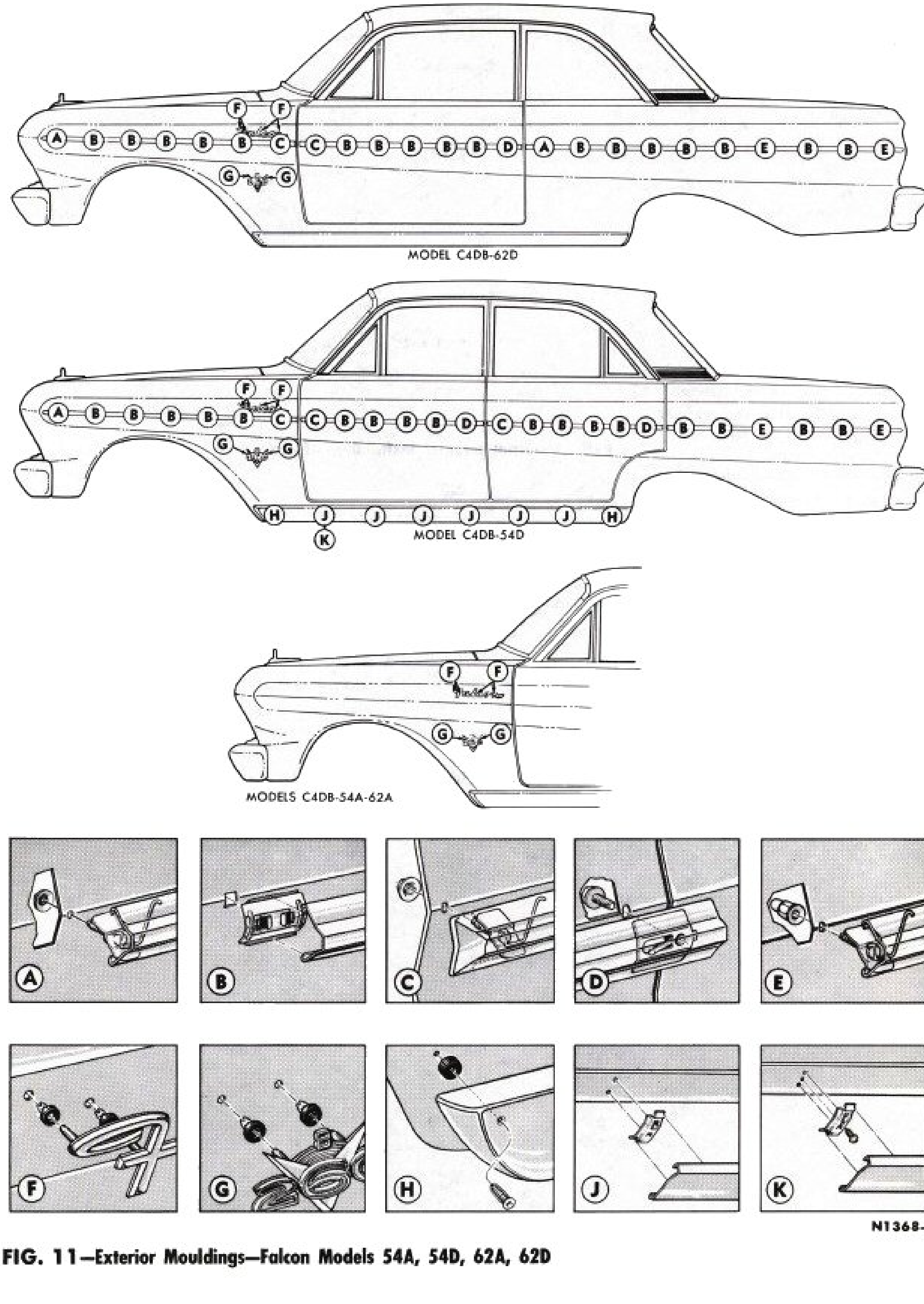


FIG. 11—Exterior Mouldings—Falcon Models 54A, 54D, 62A, 62D

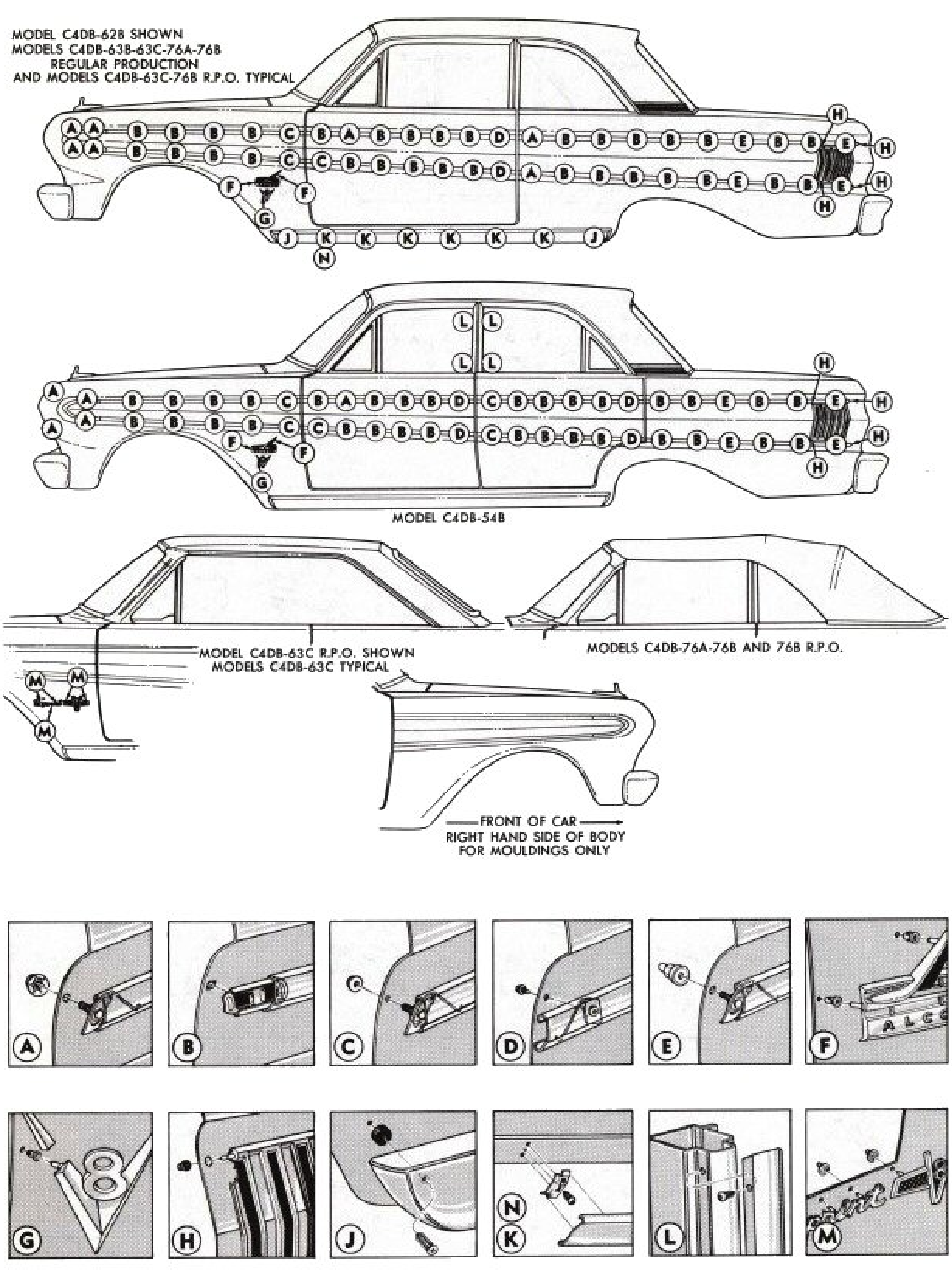


FIG. 12—Exterior Mouldings—Falcon Models 54B, 62B, 63B, 63C, 76A, 76B

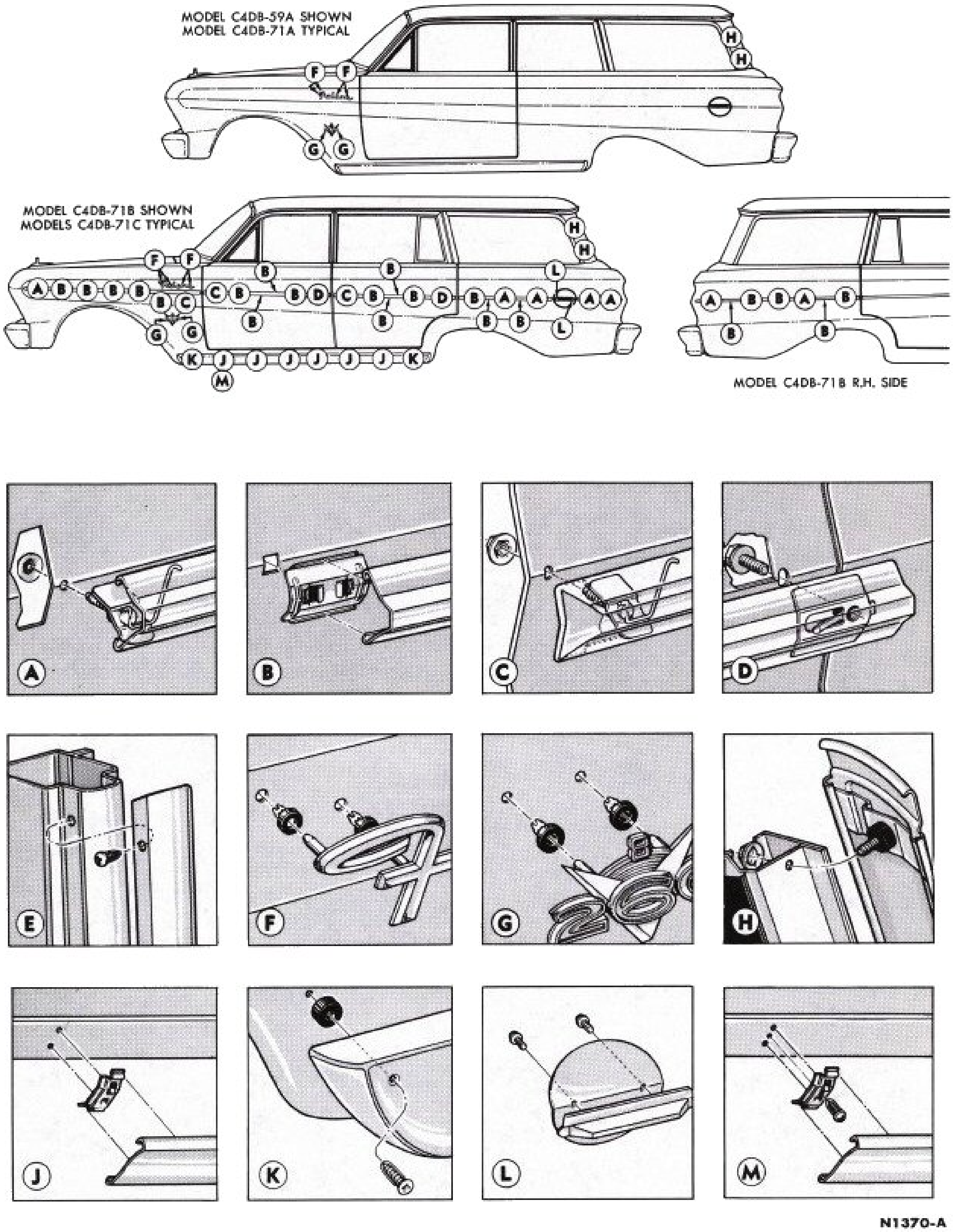
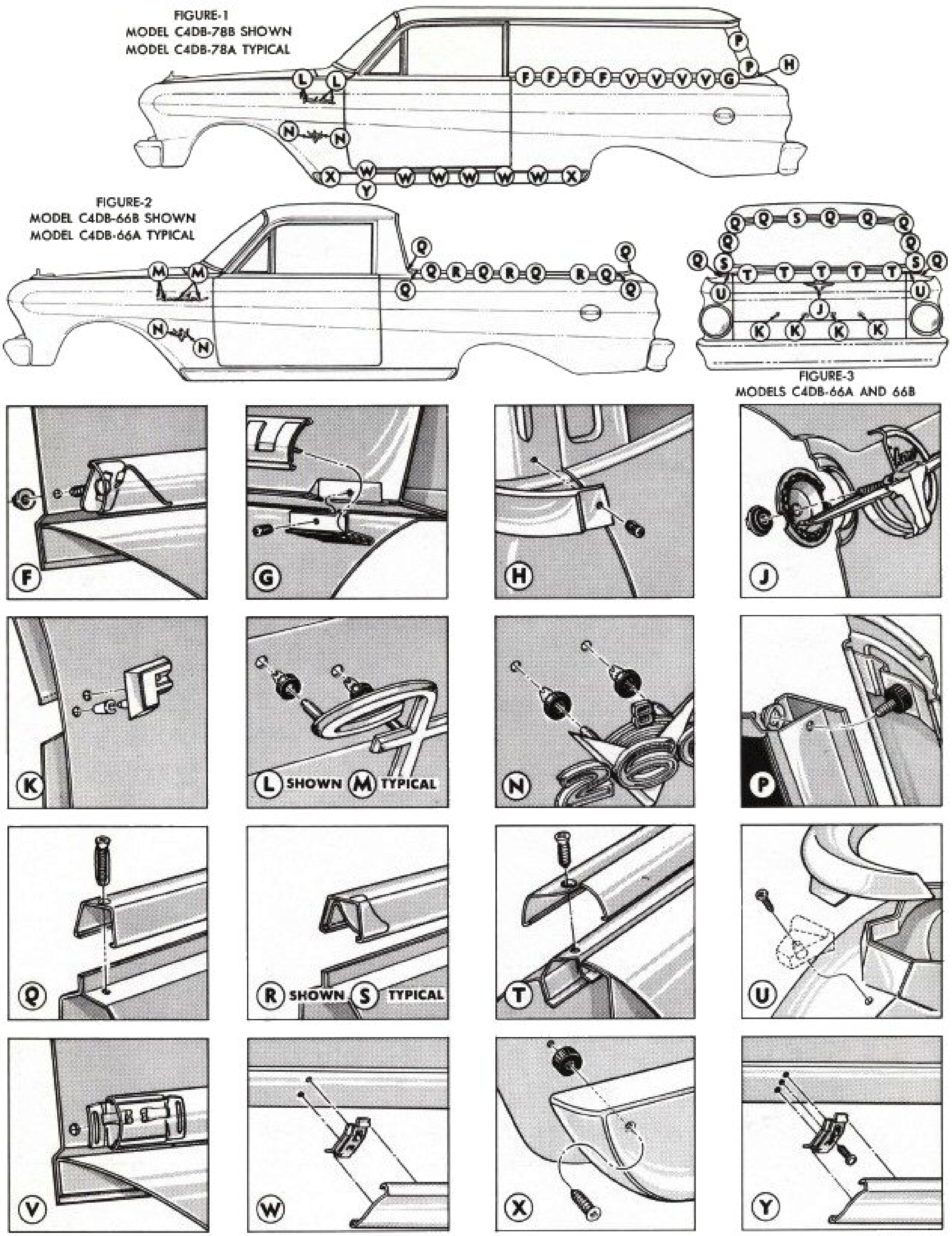


FIG. 13—Exterior Mouldings—Falcon Models 59A, 71A, 71B, 71C



N1371-A

FIG. 14—Exterior Mouldings—Falcon Models 66 and 78

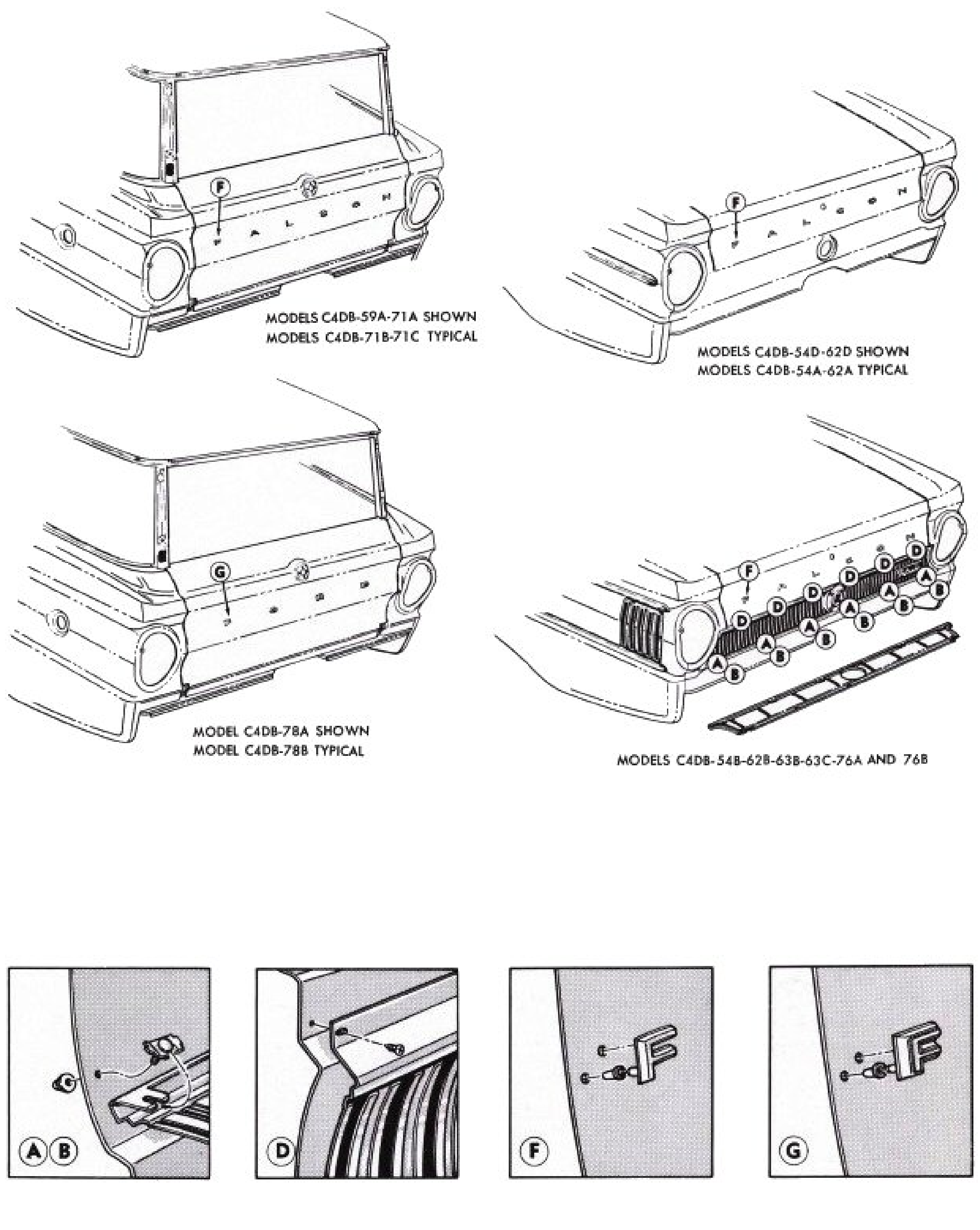


FIG. 15—Exterior Rear Mouldings—Falcon (All Except 66)

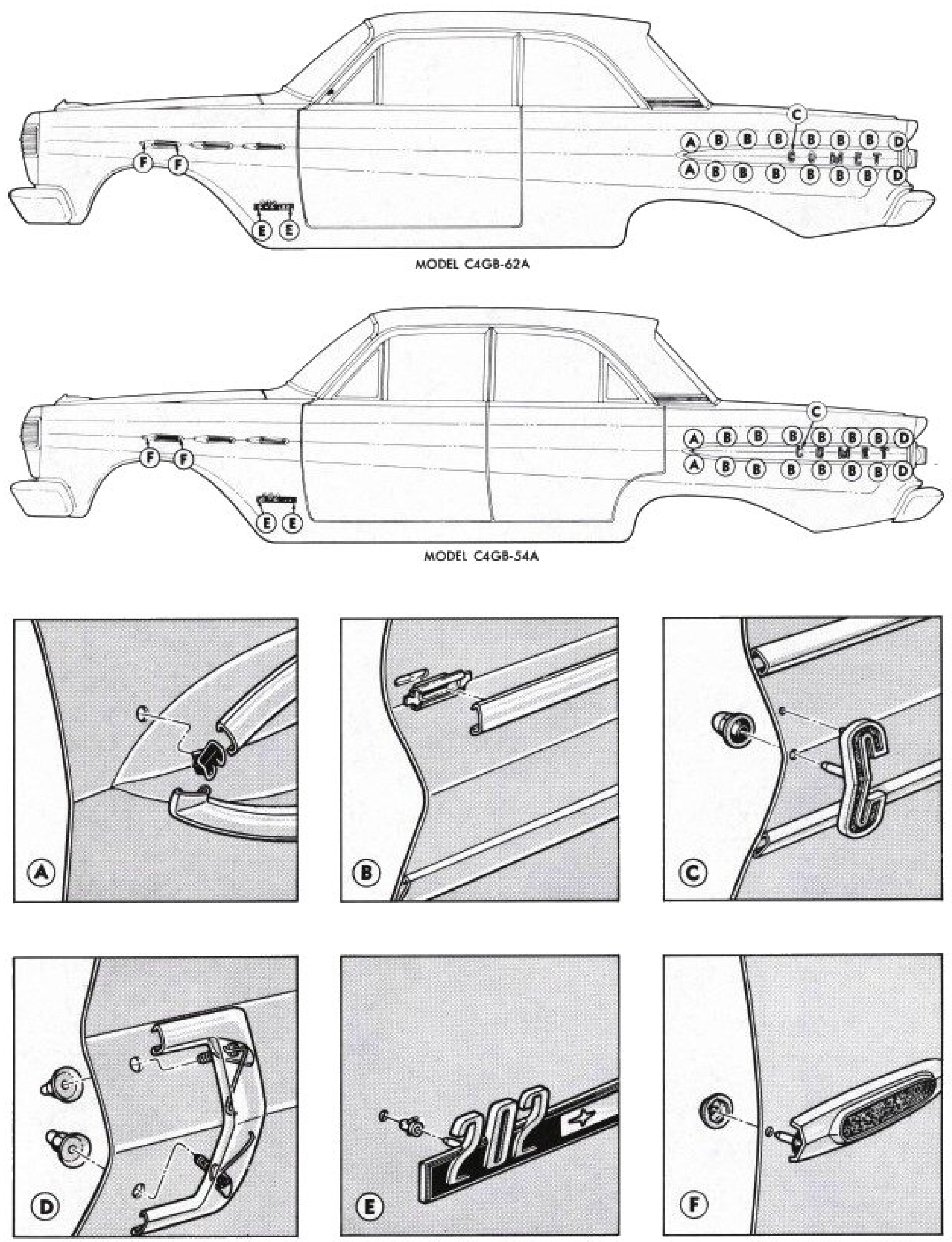


FIG. 16—Exterior Mouldings—Comet Models 54A and 62A

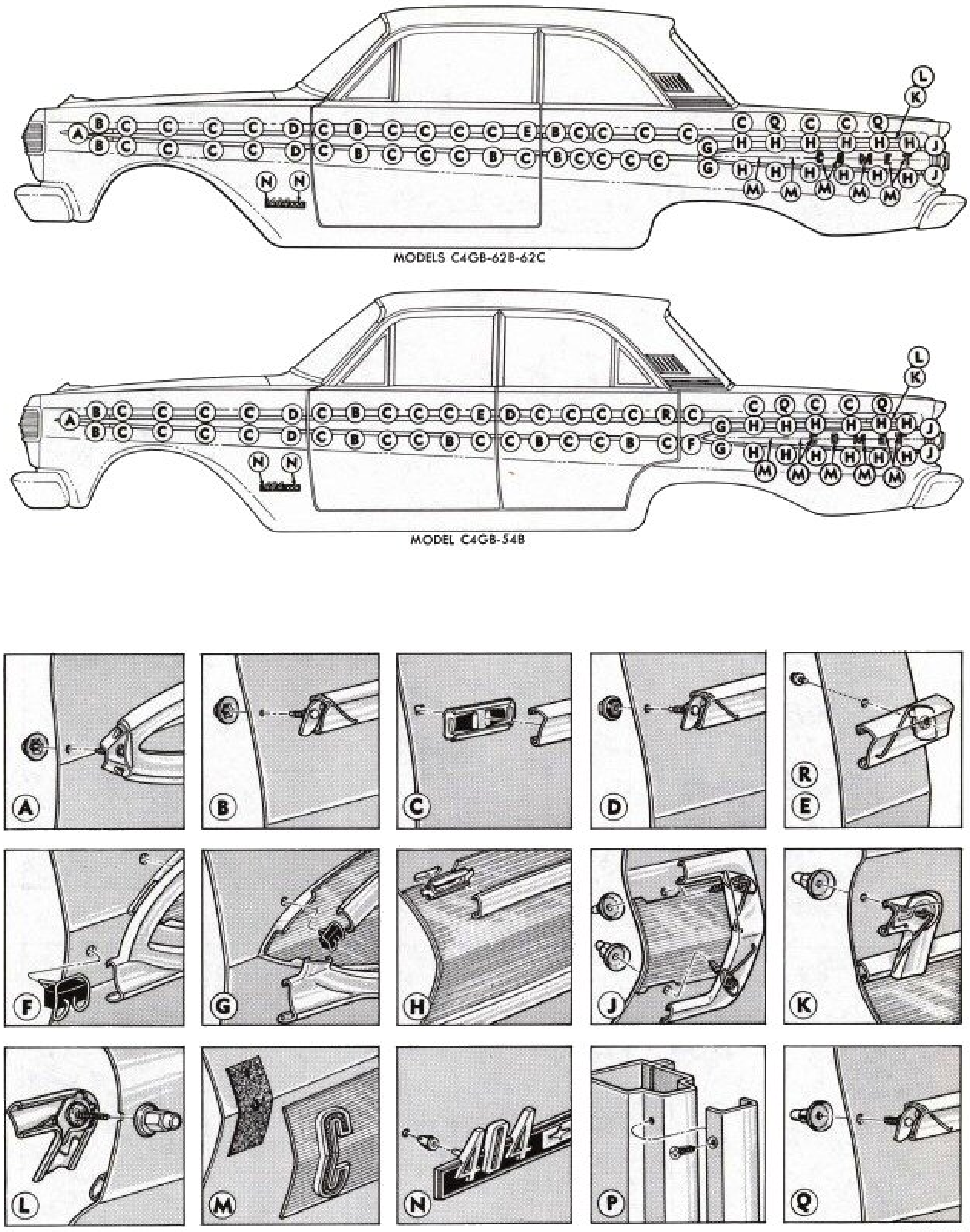


FIG. 17—Exterior Mouldings—Comet Models 54B, 62B, 62C

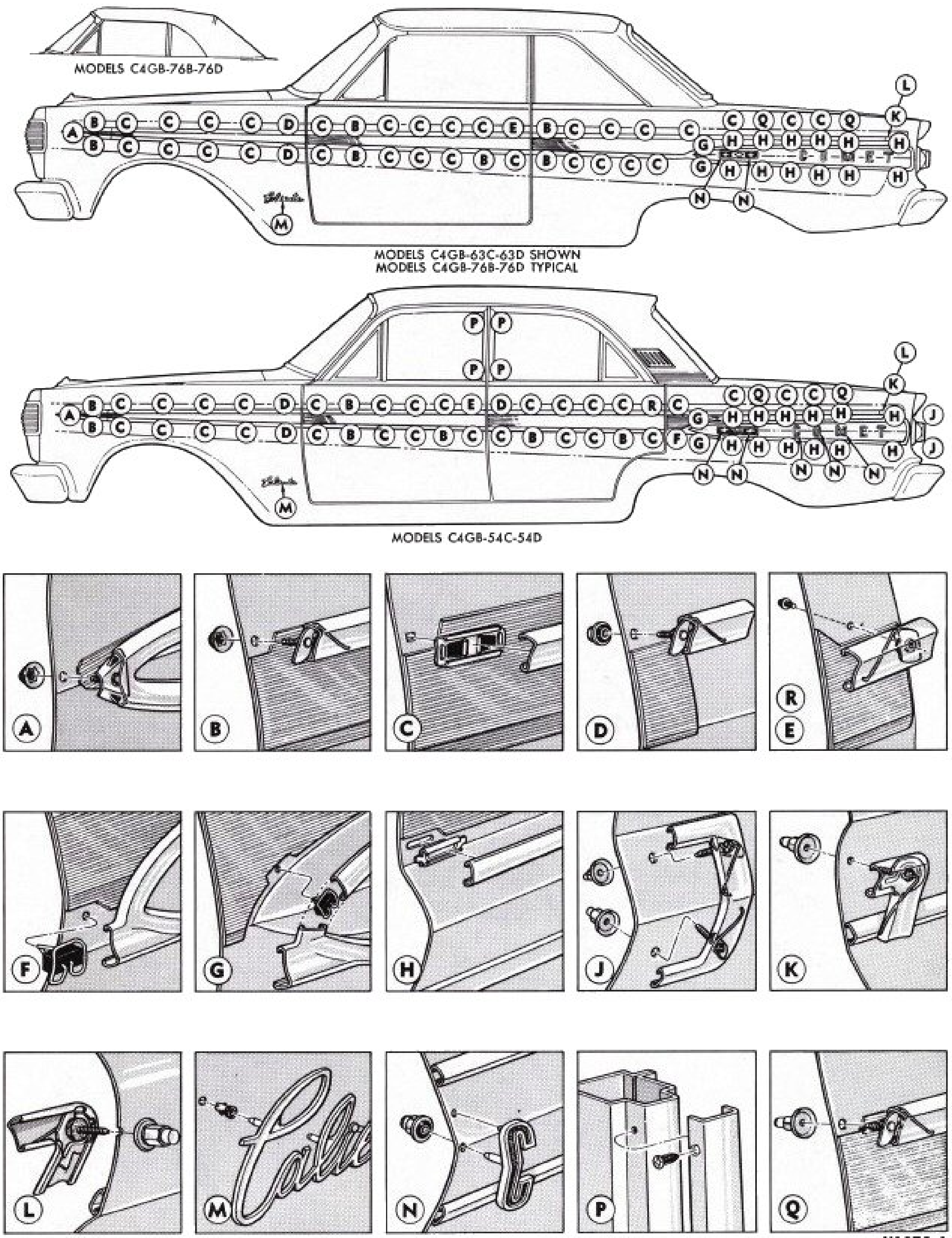
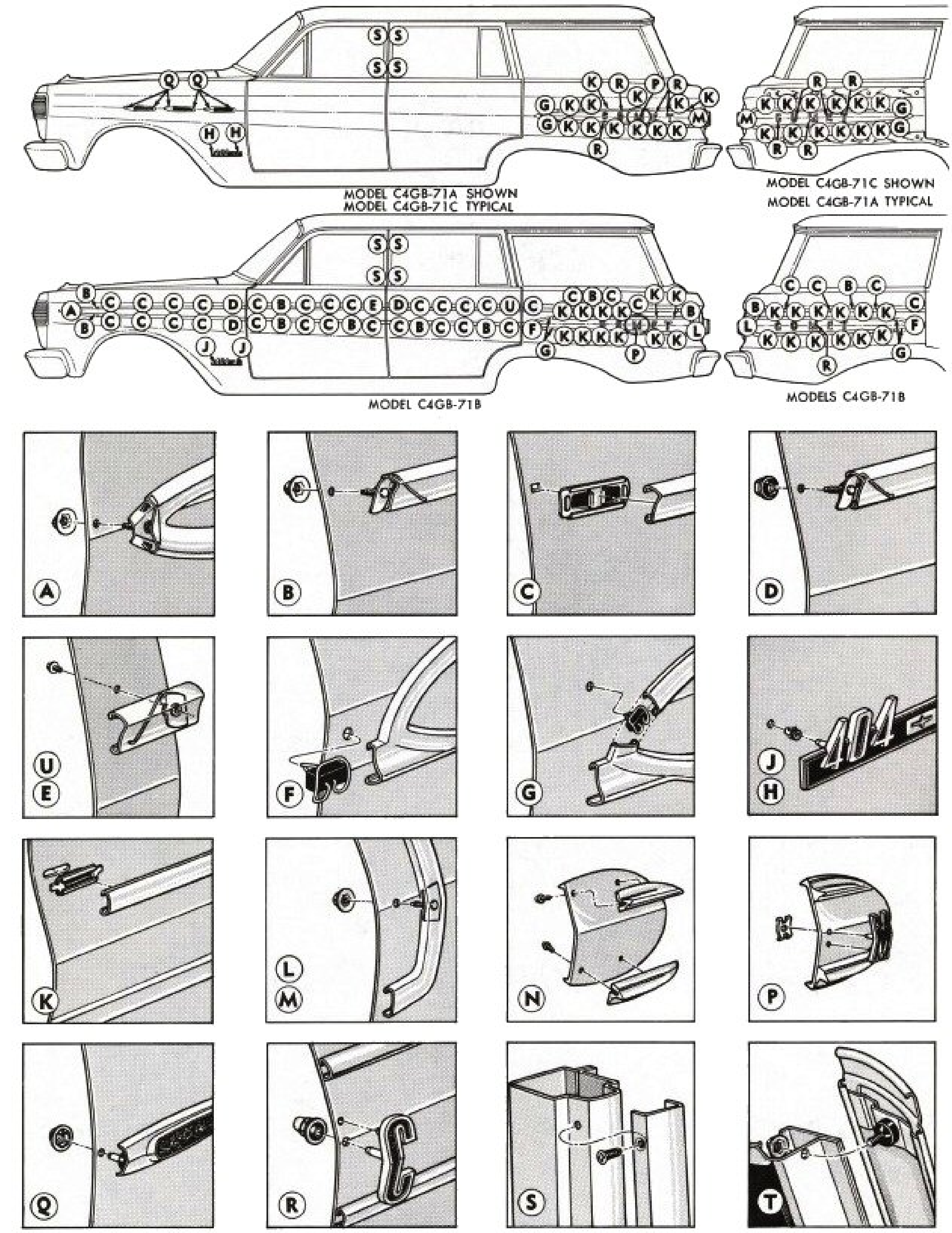


FIG. 18—Exterior Mouldings—Comet Models—54C, 54D, 63C, 63D, 76B, 76D



N1376-A

FIG. 19–Exterior Mouldings–Comet Model 71

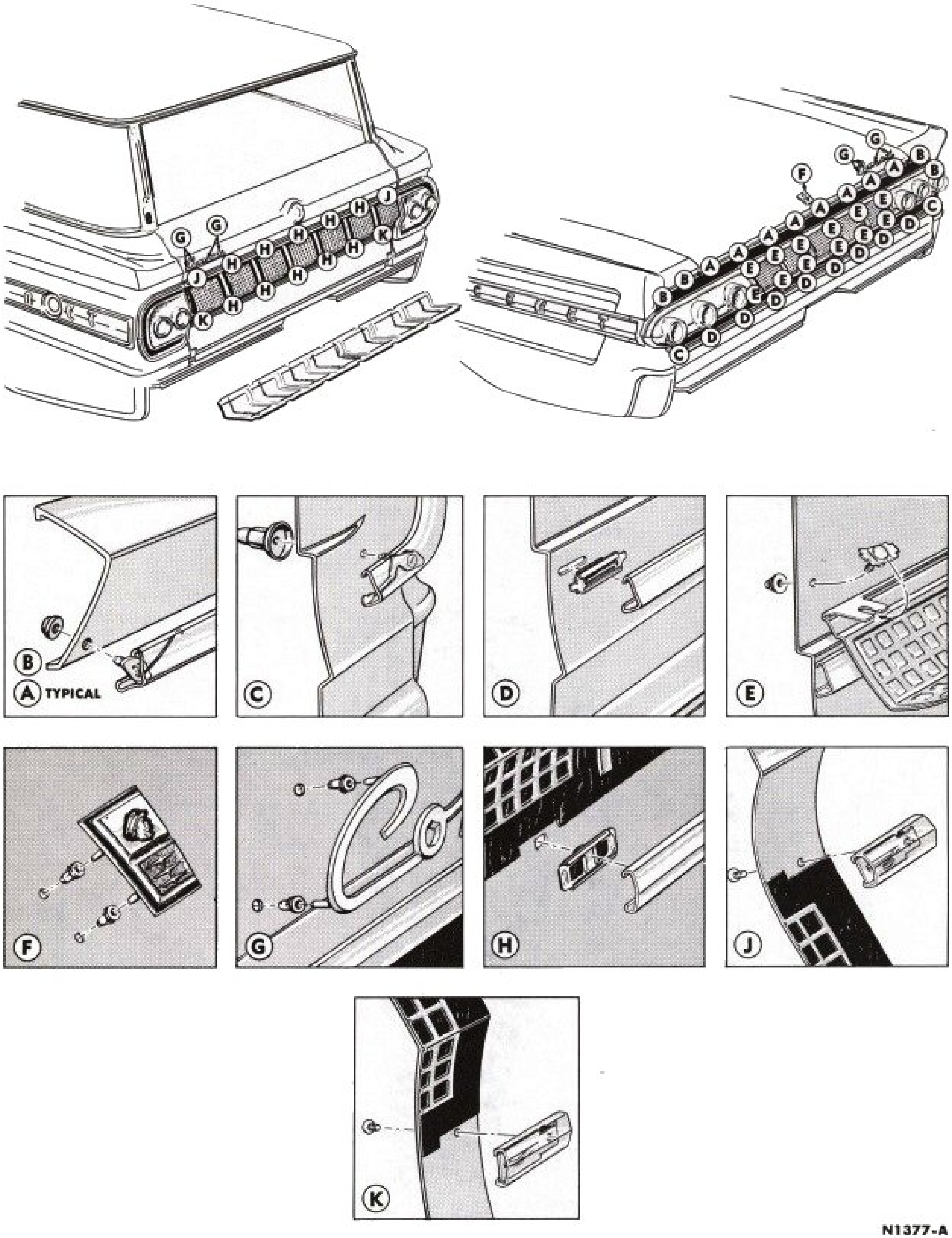


FIG. 20—Exterior Rear Mouldings—Comet Models (All)

PART 17-3 DOORS, WINDOWS, TAILGATE AND DECK LID

1 IN-CAR ADJUSTMENTS AND REPAIRS

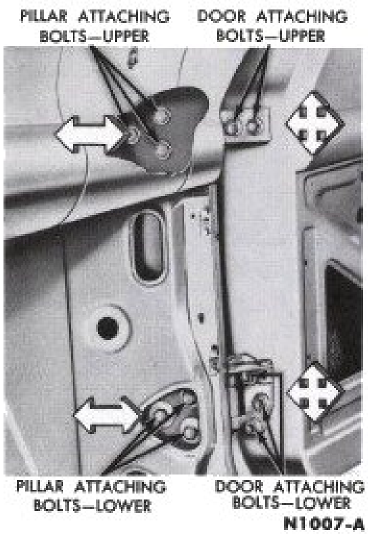


FIG. 1—Front Door Hinges

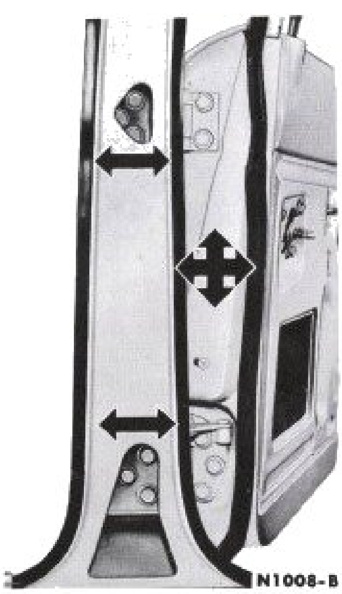


FIG. 2—Rear Door Hinges

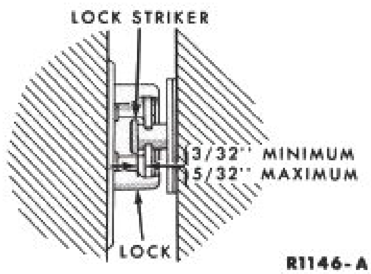


FIG. 3—Door Lock Striker Adjustment

FIG. 4—Vent Window Installed Body Type Except 63, 76

DOOR ALIGNMENT

The door hinges provide sufficient adjustment to correct most misalignment conditions. The front door hinge-to-pillar bolts are accessible after removal of the cowl side trim panel. Rear door hinge-to-pillar bolts are accessible after removal of the center body pillar inside finish panel. See Figs. 1 and 2 for adjustment points.

After adjustment at the hinge attaching points, check the alignment between the door lock and striker plate for proper door closing. **Do not cover up poor door adjustment with striker plate adjustment.**

LOCK STRIKER ADJUSTMENT

The striker pin can be adjusted

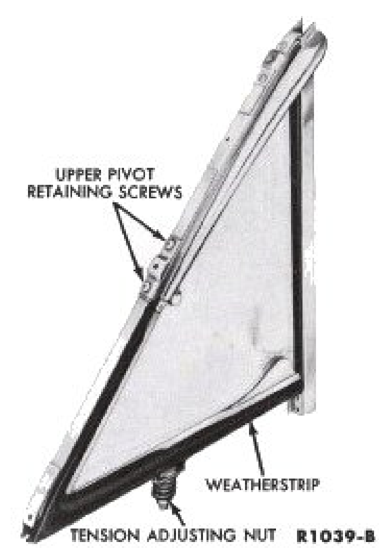


FIG. 5—Vent Window Assembly Body Types Except 63, 76

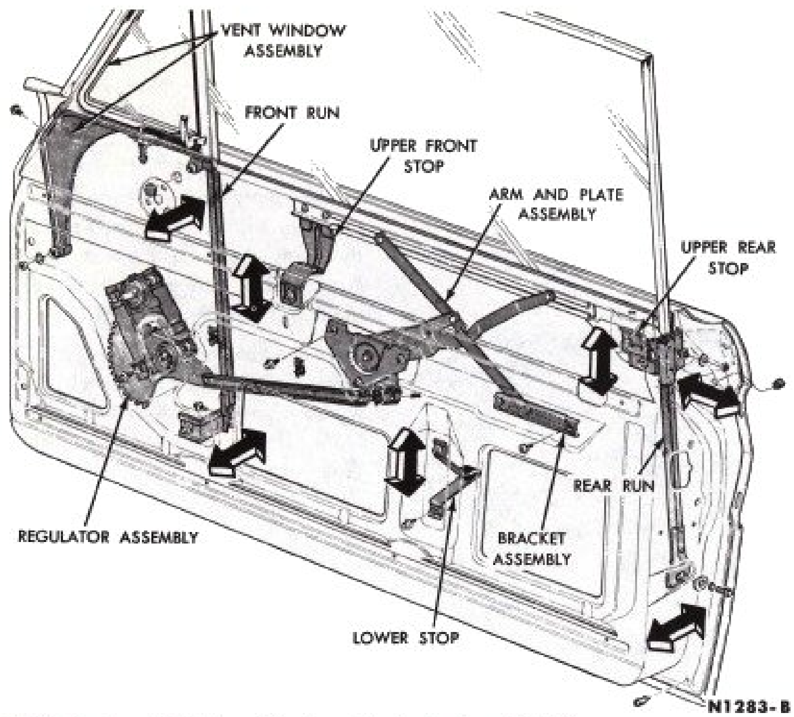


FIG. 6—Door Window Adjustments—Body Type 63, 76

laterally and vertically as well as fore and aft. **The lock striker should not be adjusted to correct door sag.** The lock striker should be shimmed to get the clearance shown in Fig. 3 between the lock striker and the lock. To check this clearance, clean the lock jaws and the striker area, and then apply a thin layer of dark grease to the lock striker. As the door is closed and opened, a measurable pattern will result. Move the striker assembly laterally to provide a flush fit at the door and the pillar or quarter panel.

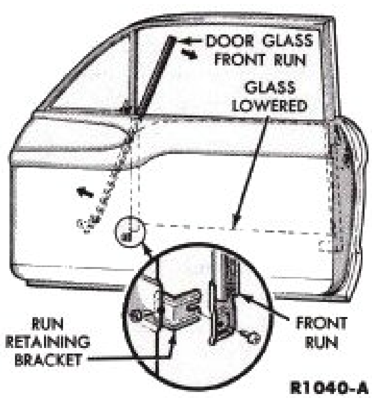


FIG. 7—Door Glass Run Removal —Body Types Except 63, 76

VENT WINDOW ADJUSTMENTS —EXCEPT MODELS 63, 76

The vent glass and/or the vent window frame may be adjusted in various ways. With the vent glass installed, the lower pivot spring tension may be adjusted with a socket, extension, and ratchet used through the access hole in the door inner panel. Adjust so that the glass will stay open at highway speeds. The door frame mounting holes (Fig. 4) are elongated to provide a tight fit for the vent window frame in the door frame. The upper pivot mounting holes are slotted to help provide a weather-proof fit of the glass frame within the vent window frame (Fig. 5).

VENT WINDOW ADJUSTMENTS —MODELS 63, 76

VERTICAL AND/OR FORE AND AFT

For proper clearance at the body

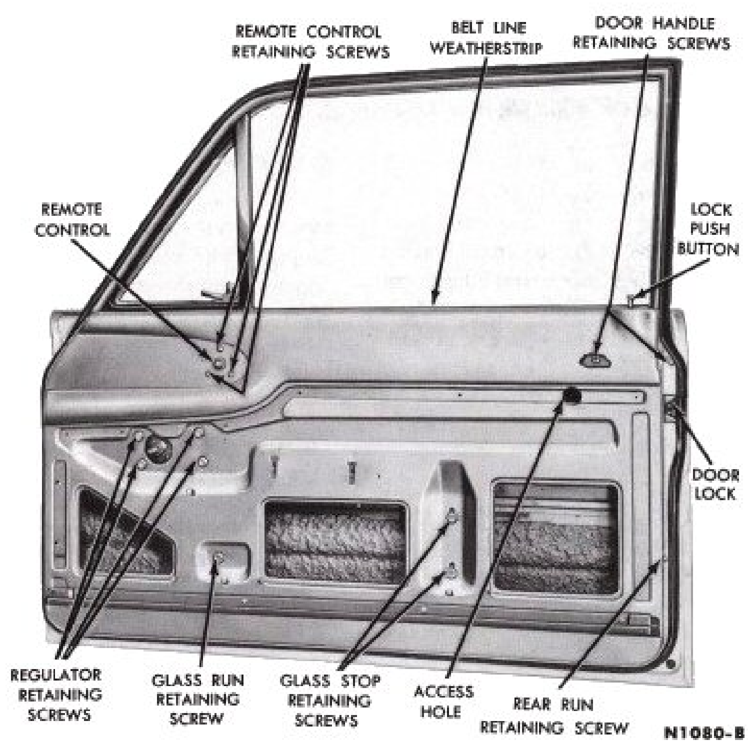


FIG. 8—Front Door—Body Types Except 63, 76

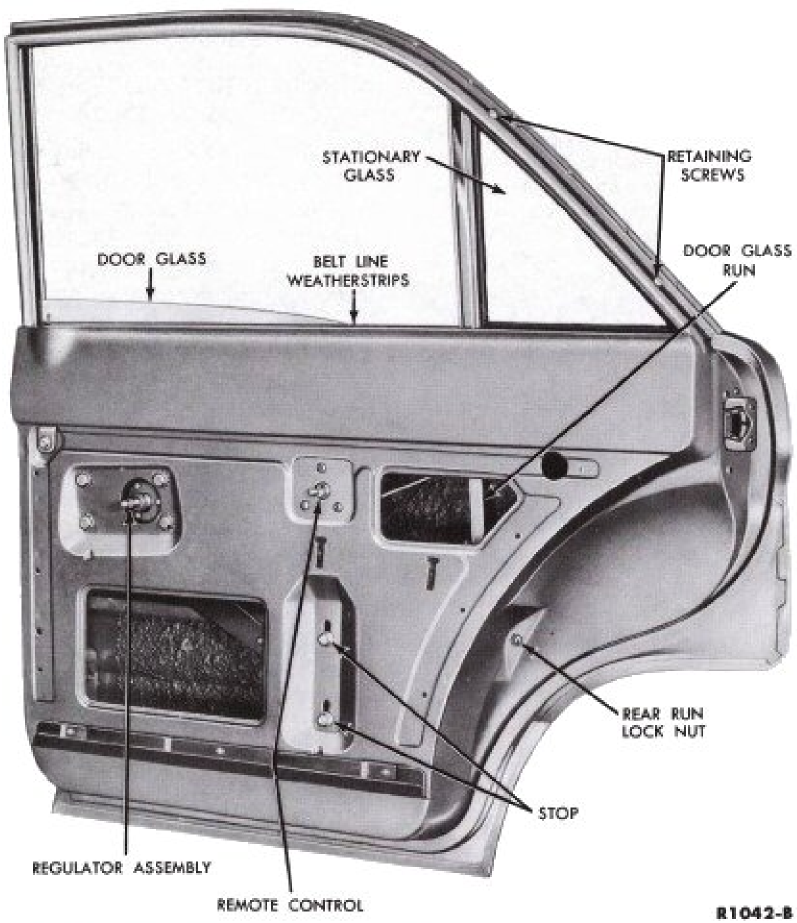


FIG. 9—Rear Door Window Adjustment

front pillar and at the roof rail weatherstrip, loosen the vent window screw and washer assembly (near the division bar), the front bracket mounting bolt, the lateral adjustment lock nut, and the vent window mounting bolt. Move the vent window as required, and tighten the mountings (Fig. 6).

LATERAL

To align the vent window with the front pillar and/or the door glass, loosen the lateral adjustment lock nut (Fig. 6), the vent window mounting bolt, the front bracket mounting bolt, and the vent window screw and washer assembly (near the division bar). Adjust the lateral position of the vent window by turning the adjustment allen screw, and then tighten the mountings.

VENT WINDOW TENSION

With the vent glass installed, the lower pivot spring tension may be adjusted with a socket, extension, and ratchet used through the access hole in the door inner panel. Adjust so that the glass will stay open at highway speeds.

FRONT DOOR GLASS ADJUSTMENT—MODELS 63, 76

The door must be properly adjusted to the body opening before any glass adjustments are made. The door trim panel must be removed to make any of the following adjustments.

Fore-and-aft adjustment for snug glass fit within the runs is made by means of the rear run upper adjusting screw at "A" (Fig. 6).

Lateral adjustment for smooth movement of the glass within the runs can be made by moving the lower ends of both the front and rear runs at "B" and "C". The vent window asembly and upper portion of the front run can be moved laterally by means of an adjusting screw which is accessible through an opening in the door inner panel at "D" (Fig. 6).

Two adjustable stops (at "E" and "F") limit the upward travel of the window, and one adjustable stop (at "G") limits its downward travel (Fig. 6).

FRONT DOOR GLASS ADJUSTMENTS—EXCEPT MODELS 63, 76

The door must be properly adjusted to the body opening before any glass adjustments are made. The door trim panel must be removed to make any of the following adjustments.

Fore-and-aft adjustment for snug glass fit within the runs may be made by using suitable shim stock between the front run and the vent window division bar. The front and/or the rear run may also be shimmed at the lower attaching point(s).

Vertical adjustment is possible by means of the single stop (Fig. 8). When the glass is fully lowered, the upper edge should be even with the belt line.

Lateral adjustment for smooth movement of the glass within the runs can be made by moving the lower attaching points of the run (Fig. 9).

REAR DOOR GLASS ADJUSTMENT

The door must be properly adjusted to the body opening before any glass or frame adjustments are made.

The trim panel must be removed to make any of the following adjustments.

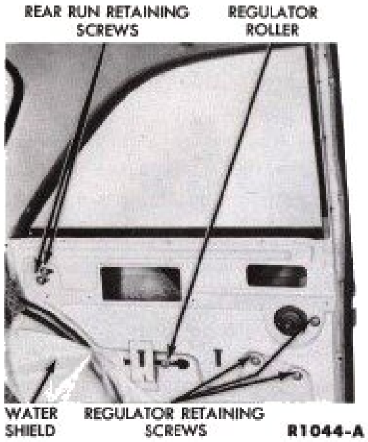


FIG. 10—Quarter Window—Body Type 62

Fore-and-aft adjustment for snug glass fit within the runs may be made by using suitable shim stock between the front run and the door frame.

Vertical adjustment is possible by means of the single stop (Fig. 9). When the glass is fully lowered, the upper edge should be even with the belt line.

Lateral adjustment for smooth movement of the glass within the runs can be made by moving the lower attaching points of the runs (Fig. 9).

QUARTER WINDOW ADJUSTMENTS—MODELS 59, 62

Fore and aft adjustments are made at the rear run (Figs. 10 and 11). Make this adjustment for a snug fit of the glass within the runs.

QUARTER WINDOW ADJUSTMENTS—MODEL 63

FORE AND AFT

With the window in its full up position, loosen the lock nuts at points "H" and "L" (Fig. 12). Loosen the front guide lower bracket retaining screws at points "E" and position the window assembly to obtain the 5/16 inch parallel dimension shown in view "AA" (Fig. 12). Tighten the lock nuts at points "H" and "L" and the front guide lower bracket retaining screws at points "E".

UP OR DOWN

With the window in its full up position, loosen the upper front stop retaining screws and the upper rear stop retaining nuts "R" (Fig. 12). Adjust the upper stops as required to obtain the ⅛ inch parallel dimension shown in view "B" (Fig. 12). Tighten the upper front stop retaining screw and the upper rear stop retaining nuts. Loosen the lower stop retaining bolt "C" (Fig. 12), and loosen the rear guide retaining screw at point "M" and the lock nut at point "L" (Fig. 12). Operate the window to its down position and adjust the lower stop so that the top of the window frame is level with the window opening. Tighten the lower stop retaining bolt.

Tighten the rear guide retaining screw at point "M" and the lock nut at point "L".

LATERAL (IN OR OUT)

With the window in its full up position, loosen the lock nut "H" and "L" (Fig. 12). Rotate the studs at points "H" and "L" in or out to obtain the 3/16 inch parallel dimension shown in view "BB" (Fig. 12). After adjustment, tighten the lock nuts. To obtain the proper alignment of the quarter window assembly with the door window glass and the proper interference fit with the roof rail weatherstrip, loosen the front guide to lower bracket retaining screws at points "E" (Fig. 12). Tilt the front guide assembly in or out as required. Tighten the retaining screws.

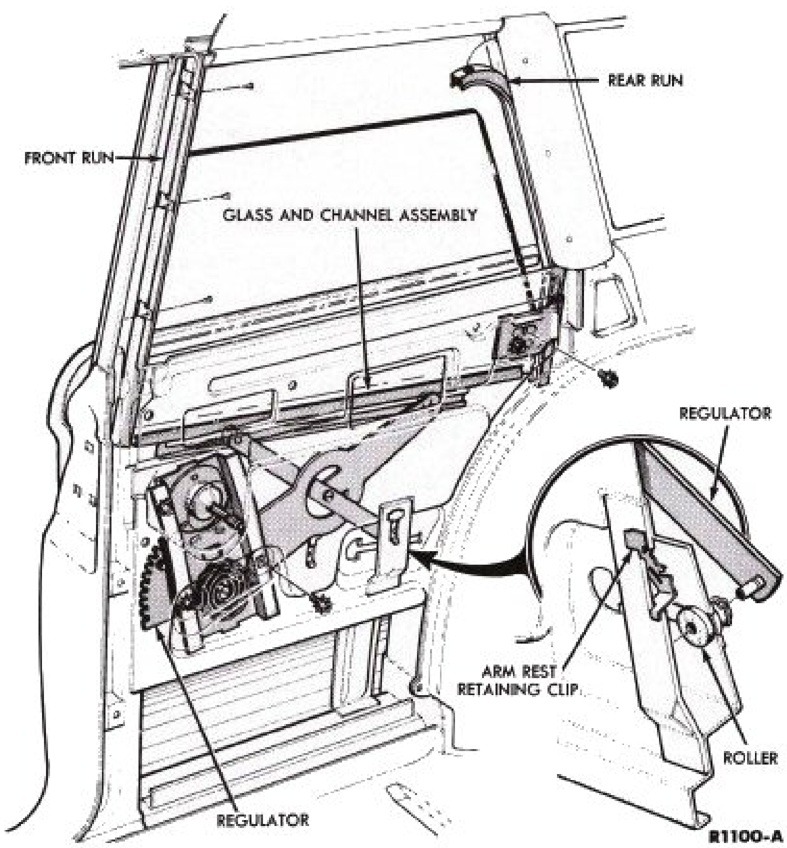


FIG. 11—Quarter Window—Body Type 59, 62

QUARTER WINDOW ADJUSTMENTS—MODEL 76

Point "A". The quarter window

front guide can be adjusted fore-and-aft and also tilted laterally.

The fore-and-aft adjustment is used to obtain the proper clearance ($\frac{9}{32}$-inch) between the rear edge of the door window frame and the front edge of the quarter window frame (Fig. 13).

Turning the adjusting screws tilts the guide and window assembly laterally.

Point "B". The front end of the equalizer arm guide can be adjusted vertically to obtain proper alignment and fit of the front upper edge of the window frame at the top side rail weatherstrip (Fig 13).

Point "C". The quarter window rear guide can be tilted by moving the lower end of the guide laterally to properly align and fit the rear upper edges of the window frame at the top side rail weatherstrip (Fig. 13).

Point "D". The upper end of the window rear guide can be adjusted laterally to properly align the upper sides of the window frame at the glass outer weatherstrip (Fig. 13).

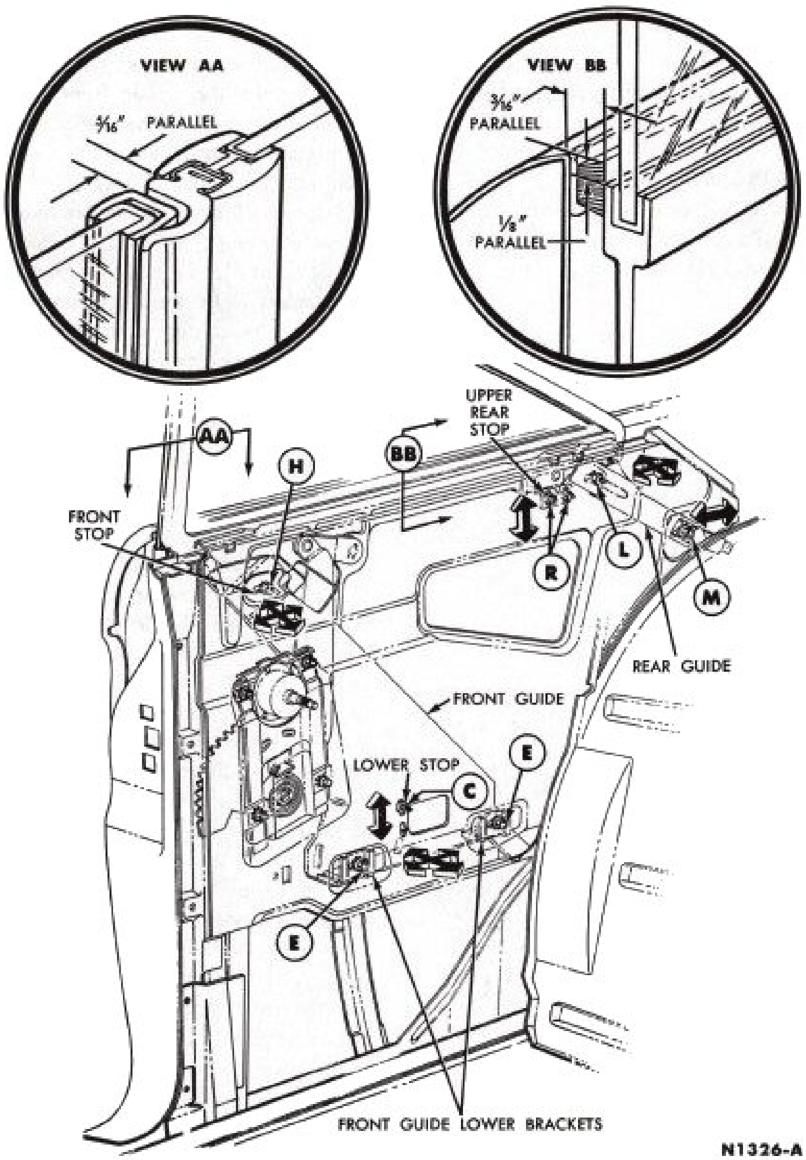


FIG. 12—Quarter Window Adjustments—Body Type 63

Point "E". The front guide lower bracket can be moved laterally to obtain the proper clearance ($\frac{3}{16}$-inch) between the quarter window and the outer quarter panel at the belt line.

Points "F" and "G". The window upper stops are adjusted up or down to obtain the $\frac{1}{8}$-inch parallel dimension between the window lower frame and the quarter panel at the belt line (Fig.13).

Point "H". The quarter window lower stop is adjusted up or down to obtain the proper level of the top edge of the window frame in the quarter panel (Fig. 13).

STATION WAGON TAILGATE ADJUSTMENTS

The tailgate window lower stops can be adjusted up or down to align the glass edge in the lowered position with the tailgate.

The tailgate regulator has enlarged mounting holes so that the regulator arms can be aligned to the glass channel.

To adjust the tailgate glass runs, remove the tailgate cover panel and then hold the tailgate in the closed position. Roll up the window and observe the runs for alignment. Lower the window, open the tailgate, and adjust the window runs as required (Fig. 14).

TAILGATE HINGE ADJUSTMENT

The tailgate can be adjusted fore or aft and up or down at the hinge to body mounting bolts.

To adjust the tailgate from side to side in the tailgate opening, remove the trim panel, loosen the hinge to tailgate bolts and shift the tailgate as required (Fig. 14).

DECK LOCK ADJUSTMENT

The striker plate can be adjusted laterally and vertically and the lock can be adjusted laterally. Before ad-

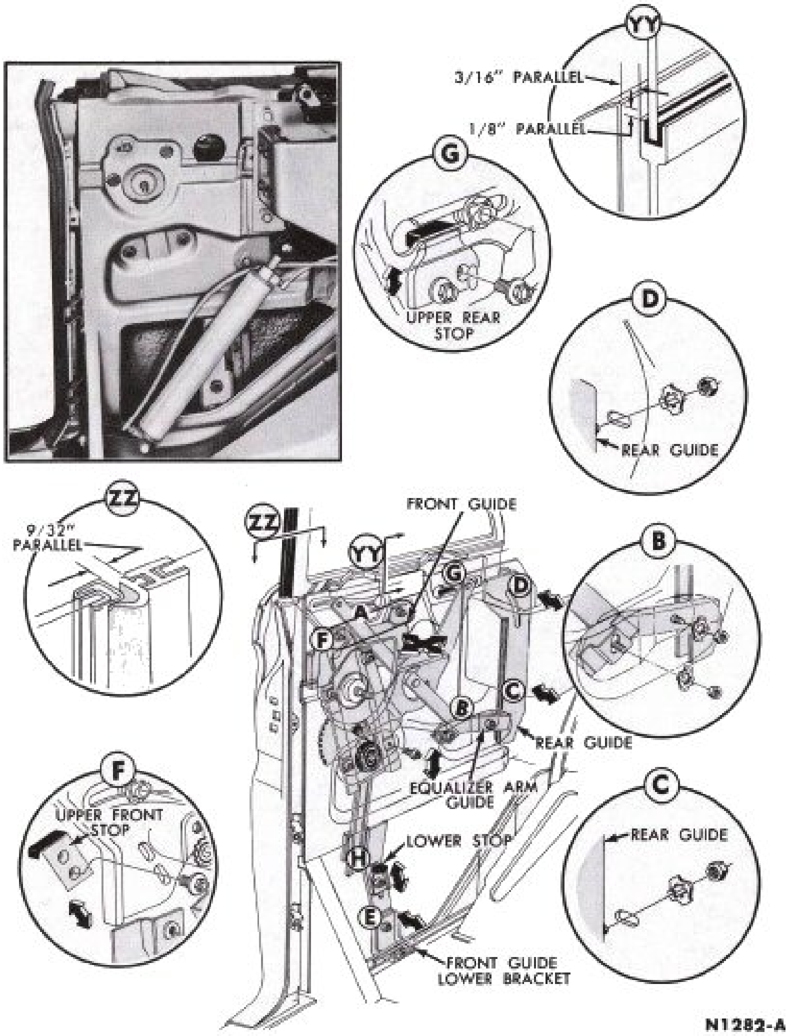


FIG. 13—Quarter Window Adjustments—Body Type 76

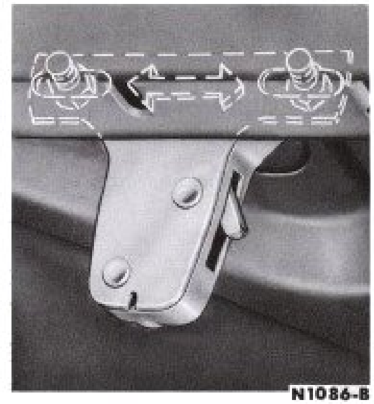


FIG. 15—Deck Lid Lock Adjustment

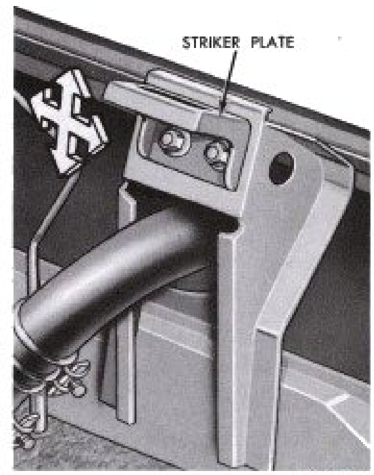


FIG. 16—Deck Lid Striker Plate Adjustment

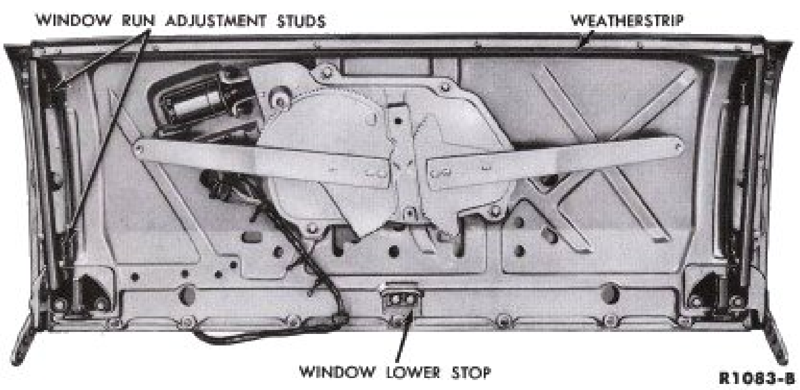


FIG. 14—Tailgate Window Run Adjustments

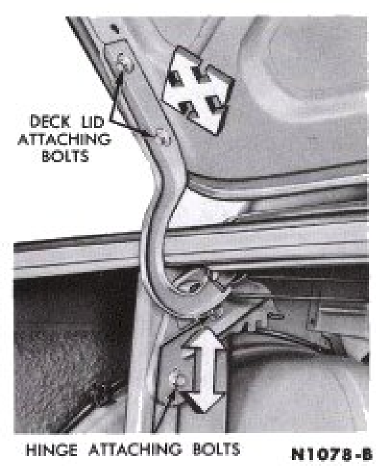


FIG. 17—Deck Lid Adjustments

justing the deck lid lock, make sure the deck lid is properly aligned. To adjust the lock, loosen the two attaching screws, move the lock as required to make good contact and tighten the attaching screws. Move the striker plate up or down as necessary to increase or decrease the clearance between the deck lid and the lower back panel (Figs. 16 and 15).

DECK LID ALIGNMENT

The deck lid can be shifted fore and aft, up and down, and from side to side. Slotted holes in the lid provide fore and aft movement. Slotted hinge bolt holes in the mounting bracket provide up and down movement. Enlarged hinge mounting bolt holes in the lid inner panel provide limited lateral movement (Fig. 17).

2 REMOVAL AND INSTALLATION

FRONT DOOR

REMOVAL

1. Remove the five door hinge to door attaching bolts, and remove the door (Fig. 10).

2. If a hinge is damaged, remove the pillar attaching bolts and remove the hinge.

3. If the door is damaged, a replacement door is furnished as a sheet metal shell in prime paint. It has no hinges, trim, glass, runs, or hardware. When a door is replaced, make any needed minor repairs to the new shell, drill holes necessary for mouldings, paint the door, and transfer all usable parts. Cement the weatherstrip properly.

If only a door outer panel is seriously damaged, the whole door need not be replaced. A replacement outer panel is available.

INSTALLATION

1. If the hinge was removed, install it to the front pillar.

2. Position the door to the hinges. Partially tighten the bolts, align the door, and tighten the bolts securely.

3. Align the front door glass, glass runs, stops, regulator, and remote control.

4. Install the front door water shield and the front door trim.

REAR DOOR

REMOVAL

1. Remove the five door hinge to door attaching bolts, and remove the door (Fig. 2).

2. If a hinge is damaged, remove the pillar attaching bolts, and remove the hinge.

3. If the door is damaged, a replacement door is furnished as a sheet metal shell in prime paint. It has no hinges, trim, glass, runs, or hardware. When a door is replaced, make any needed minor repairs to the new shell, drill holes necessary for mouldings, paint the door, and transfer all usable parts. Cement the weatherstrip properly.

If only a door outer panel is seriously damaged, the whole door need not be replaced. A replacement outer panel is available.

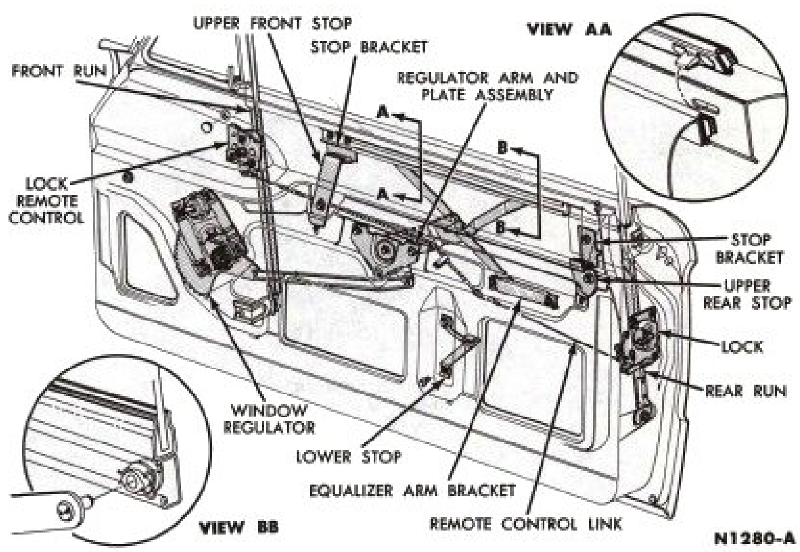


FIG. 18—Door Window and Lock Mechanism—Body Types 63, 76

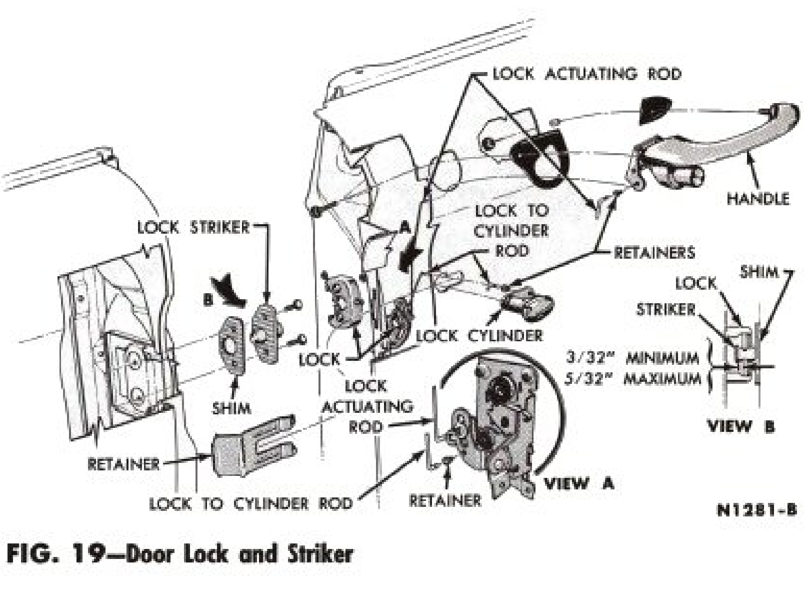


FIG. 19—Door Lock and Striker

INSTALLATION

1. If the hinge was removed, install it to the rear pillar.

2. Position the door to the hinges. Partially tighten the bolts, align the door and tighten the bolts securely.

3. Align the rear door glass, glass runs, stops, regulator, and remote control.

4. Install the rear door water shield and the rear door trim.

FRONT DOOR LOCK—MODELS 63, 76

REMOVAL

1. Remove the trim panel and position water shield away from the access holes.

2. Remove both window upper stop brackets from the glass lower channel, and remove the rollers from the regulator arms (Fig. 18). Remove the glass assembly.

3. Disconnect the door lock remote control link, the lock actuating rod, and the lock control to cylinder rod at the lock (Fig. 18). Remove the knob from the push button rod.

4. Remove the glass rear run lower retaining bolt. Remove the run upper adjusting screw lock nut. **Do not disturb the position of the adjusting screw.** Remove the run from the door.

5. Remove the lock assembly from the door. Remove the push button rod from the lock.

INSTALLATION

1. Install new sleeve nuts (retainers) on the lock assembly. Connect the push button rod to the lock.

2. Position the lock in the door, and install the retaining screws. Connect the lock control to cylinder rod, the lock actuating rod, and the remote control link at the lock. Install the push button.

3. Position the glass rear run in the door. Install, and snugly tighten, the lower retaining bolt and the upper adjusting screw lock nut.

4. Position the glass assembly in the door. Install the rollers in the glass lower channel, and connect both regulator arms. Install the window upper stop brackets.

5. Check the window operation and, if necessary, adjust the rear run. Tighten the lower retaining bolt and the upper adjusting screw lock nut.

6. Check the operation of the lock. If necessary, adjust the lock striker.

7. Carefully position the water shield to the inner panel, and install the trim panel.

FRONT DOOR LOCK—EXCEPT MODELS 63, 76

REMOVAL

1. Remove the trim panel and position the water shield away from the access holes.

2. Disconnect the door lock remote control link, the lock actuating rod and the lock control to cylinder at the lock (Fig. 19). Remove the knob from the push button rod.

3. Remove the glass rear run lower retaining bolt and position the run away from the door lock.

4. Remove the lock assembly from the door. Remove the push button rod from the lock.

INSTALLATION

1. Install new sleeve nuts (retainers) on the lock assembly. Connect the push button rod to the lock.

2. Position the lock in the door, and install the retaining screws. Connect the lock control to cylinder rod, the lock actuating rod, and the remote control link at the lock. Install the push button.

3. Position the glass rear run in the door. Install the retaining bolt, adjust the rear run, and tighten the retaining bolt.

4. Check the operation of the lock. If necessary, adjust the lock striker.

5. Carefully position the water shield to the inner panel; and install the trim panel.

REAR DOOR LOCK

REMOVAL

1. Remove the trim panel and

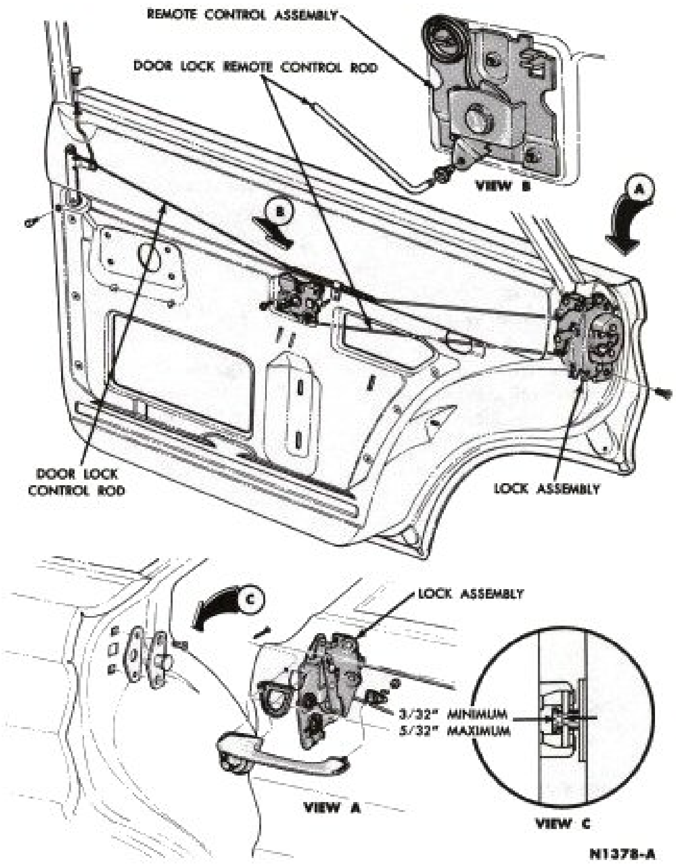


FIG. 20—Rear Door Handle and Lock

position the water shield away from the access holes.

2. Disconnect the door lock remote control rod and door lock control rod at the door lock assembly.

3. Remove the lock assembly from the door (Fig. 20).

INSTALLATION

1. Install new sleeve nuts (retainers) on the lock assembly.

2. Position the lock assembly in the door, and install the retaining screws.

3. Connect the door lock remote control rod and the door lock control rod at the door lock assembly.

4. Check the operation of the lock. If necessary, adjust the lock striker.

5. Carefully position the water shield to the inner panel, and install the trim panel.

DOOR LOCK CYLINDER

The key code is stamped on the lock cylinder to assist in replacing lost keys.

When a lock cylinder is replaced, both door lock cylinders and the ignition lock cylinder should be replaced in a set. This will avoid carrying an extra key which will fit only one lock.

1. Remove the trim panel and position the water shield away from the access holes.

2. Disconnect the lock control to door lock cylinder rod at the lock cylinder.

3. Pull the door lock cylinder retainer rearward to release the cylinder, and remove the lock cylinder from the door.

4. Transfer the lock cylinder arm to the new lock cylinder.

5. Position the lock cylinder in the door, and install the lock cylinder retainer (Fig. 19).

6. Connect the lock control to door lock cylinder rod at the lock cylinder.

7. Carefully position the water shield to the inner panel and install the trim panel.

DOOR HANDLE AND/OR PUSH BUTTON

1. Remove the door trim panel, and position the water shield away from the access holes.

2. Remove the handle retaining screw and nut, and remove the handle (Fig. 19). To remove the front door handle, it will be necessary to disconnect the lock actuating link.

3. To replace the push button, remove the retaining plate screw, retaining plate, spring, push button, and rubber seal from the handle.

4. Install the push button assembly if it was removed, and install the handle assembly. Connect the lock actuating link to the door handle.

5. Carefully position the water shield to the inner panel, and install the trim panel.

VENT WINDOW OR WEATHERSTRIP—EXCEPT MODELS 63, 76

REMOVAL

The vent window glass may be removed and/or installed by using the tool shown in Fig. 21. When installing new glass, use the new glass tape, and apply sealer to the frame horizontal channel and to the other channel in the area of the upper pivot.

1. Remove the door trim panel and position the water shield away from the access holes.

2. Remove the glass stop (Fig. 8) and the front run bracket retaining bolt. Loosen the front run retaining bracket at the inner panel (Fig. 7). Lower the window completely.

3. Pry the door glass front run out of the vent window division bar and remove the run.

4. Remove the vent window frame mounting screw from the belt line of the door (Fig. 4).

5. After carefully pulling away the door weatherstrip from the upper forward area of the door frame, remove the remaining frame mounting screws and the vent window and frame.

6. Remove the upper pivot from the frame, and remove the lower pivot spring assembly. **Note the position of the stop washer and the flat washers.**

7. Remove the weatherstrip.

INSTALLATION

1. Install the weatherstrip.

2. Install the pivot and the pivot spring assembly. Adjust the spring tension so that the vent glass will stay open when the car is driven at highway speeds.

3. Install the vent window and frame in the door frame.

4. Install the front run and its bracket, adjusting the bracket position to get correct door glass lateral position and snug fore-and-aft door glass fit.

5. Install the stop, adjusting it for proper door glass height at the belt line with the glass lowered.

6. Carefully position the water shield to the inner panel and install the trim panel.

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FIG. 21—Glass Channel Replacement

VENT WINDOW OR WEATHERSTRIP—MODELS 63, 76

REMOVAL

The vent window glass may be removed and/or installed by using the tool shown in Fig. 21. When installing new glass, use new glass tape, and apply sealer to the frame horizontal channel and to the other channel in the area of the upper pivot.

1. Remove the door trim panel and position the water shield away from the access holes.

2. Remove the front run bracket retaining bolt, and position the run out of the vent window division bar (Fig. 6).

3. Remove the door vent window assembly retaining bolts and retaining nut, and remove the vent window assembly.

4. Remove the upper pivot from the frame and remove the lower pivot spring assembly, then remove the vent window and frame

5. Remove the weatherstrip.

INSTALLATION

1. Install the weatherstrip.

2. Position the vent window and frame into the vent assembly.

3. Install the pivot and the pivot spring assembly. Adjust the spring tension so that the vent glass will stay open when the car is driven at highway speeds.

4. Position the vent window assembly in the door and install the retaining bolts and retaining nut snugly.

5. Position the front run in the vent window division bar and install the retaining bolt snugly.

6. Align the vent window and front run and tighten the retaining bolts and retaining nut.

7. Carefully position the water shield to the inner panel and install the trim panel.

FRONT DOOR GLASS — EXCEPT MODELS 63, 76

REMOVAL

1. Remove the trim panel and position the water shield away from the access holes.

2. After removing the stop (Fig. 21), lower the glass until the regulator arm roller is out of the glass channel.

3. Unsnap and remove the belt weatherstrips, loosen the front run attaching bolt at the mounting bracket, and remove the bracket attaching bolt from the inner panel.

4. Remove the front run from the division bar by pulling rearward on the edges of the run.

5. Remove the glass (Fig. 22).

INSTALLATION

1. Using the tool shown in Fig. 21, remove the channel from the glass.

2. Install the channel, using new glass tape.

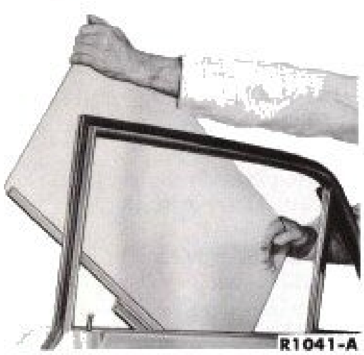

FIG. 22—Door Glass Removal—Body Types Except 63, 76

3. Simultaneously, position the glass and run in the door, and install the belt weatherstrips.

4. Position the regulator arm roller in the channel, and finally position the run in the division bar.

5. Connect the run and bracket, making necessary lateral adjustment.

6. Install the stop, making necessary adjustment.

7. Carefully position the water shield, the inner panel, and install the trim panel.

FRONT DOOR GLASS—MODELS 63, 76

REMOVAL

1. Remove the trim panel and position the water shield away from the access holes.

2. Remove both window upper stop brackets from the glass lower channel. Disconnect both window regulator arms from the lower channel, and remove the rollers. Remove the glass assembly (Fig. 18).

INSTALLATION

1. Remove the glass upper frame to lower channel retaining screws, and remove the frame. Remove the lower channel from the glass (Fig. 21).

2. Install a new glass tape and the lower channel on the glass. Install the glass upper frame.

3. Position the glass assembly in the door. Install the rollers in the glass lower channel, and connect both regulator arms. Attach the window upper stop brackets to the lower channel.

4. Carefully position the water shield to the inner panel and install the trim panel.

FRONT DOOR WINDOW REGULATOR—MODELS 63, 76

REMOVAL

1. Remove the trim panel and position the water shield away from the access holes.

2. Remove the remaining bolts from the door window regulator arm and plate.

3. Disconnect the front arm and plate arm from the glass channel roller and position the arm and plate down.

4. Remove the retaining pin from the arm and plate and remove the regulator arm.

5. Remove the regulator retaining bolts and remove the regulator through the door access hole (Fig. 18).

INSTALLATION

1. Position the regulator inside the door and install the retaining bolts snugly.

2. Connect the regulator arm to the arm and plate and install the retaining pin.

3. Connect the front arm and plate arm to the lower glass channel.

4. Correctly position the arm and plate in the door and install the retaining bolts snugly.

5. Carefully position the water shield to the inner panel and install the trim panel.

FRONT DOOR WINDOW REGULATOR—EXCEPT MODELS 63, 76

REMOVAL

1. Remove the trim panel and position the water shield away from the access holes.

2. Disconnect the regulator from the glass channel roller.

3. Raise the glass by hand and secure it in the raised position.

4. Remove the regulator retaining bolts and remove the regulator through the door access hole (Fig. 8).

INSTALLATION

1. Position the regulator inside the door and install the retaining bolts snugly.

2. Lower the glass and connect the regulator.

3. Check the operation of the glass. Adjust if necessary, and tighten the retaining bolts.

4. Carefully position the water shield to the inner panel and install the trim panel.

FRONT DOOR REAR GLASS RUN —MODELS 63, 76

REMOVAL

1. Remove the trim panel and position the water shield away from the access holes.

2. Remove both window upper stop brackets from the glass lower channel.

3. Disconnect both regulator arms from the glass lower channel, and remove the rollers. Remove the glass assembly.

4. Remove the glass rear run lower retaining bolt. Remove the run upper adjusting screw lock nut. **Do not disturb the position of the adjusting screw.** Remove the run from the door.

INSTALLATION

1. Position the rear run in the door and install the lower retaining bolt and upper adjusting screw lock nut snugly.

2. Position the glass assembly in the door. Install the rollers in the glass lower channel, and connect both regulator arms.

3. Attach the window upper stop brackets to the lower channel.

4. Adjust the rear run and tighten the retaining bolt and nut.

5. Carefully position the water shield to the inner panel and install the trim panel.

REAR DOOR GLASS

REMOVAL

1. Remove the trim panel and position the water shield away from the access holes.

2. Remove the window regulator and the stop, and lower the window to the bottom of the door.

3. Remove the belt weatherstrips, and remove the rear run adjusting nut (Fig. 9). Disconnect the remote control anti-rattle clip (Fig. 20).

4. Pull down the rear run enough to clear the door frame, and then remove it by pulling it forward and out of the division bar.

5. Tilt the rear edge of the glass to the bottom of the door and then remove the glass.

INSTALLATION

1. Transfer the channel or the glass, using the tool shown in Fig. 21.

2. Simultaneously position the glass and the run in the door, and install the belt weatherstrips.

3. Finally, position the run, press it into the division bar, and install the run adjustment nut finger-tight.

4. Install the regulator and the stop, adjusting the stop as required.

5. Connect the anti-rattle clip, and make any necessary lateral adjustment in the runs. Tighten the adjustment nuts.

6. Carefully position the water shield to the inner panel, and install the trim panel.

REAR DOOR WINDOW REGULATOR

REMOVAL

1. Remove the trim panel and position the water shield away from the access holes.

2. Disconnect the regulator from the glass channel roller.

3. Raise the glass by hand and secure it in the raised position.

4. Remove the regulator retaining bolts and remove the regulator through the door access hole (Fig. 9).

INSTALLATION

1. Position the regulator inside the door and install the retaining bolts snugly.

2. Lower the glass and connect the regulator.

3. Check the operation of the glass, adjust if necessary, and tighten the retaining bolts.

4. Carefully position the water shield to the inner panel and install the trim panel.

QUARTER GLASS—MODEL 59

REMOVAL

1. Remove the quarter window handle.

2. Remove the ash tray and arm rest assembly.

3. Remove the screw retaining the rear edge of the trim panel, and then remove the trim panel lower retainer.

4. Unsnap the trim panel retaining clips and remove the trim panel.

5. Remove the front and lower garnish mouldings.

6. Position the water shield away from the access hole.

7. Remove the screws retaining the front run to the door pillar (Fig. 11).

8. Disconnect the regulator arms from the rollers in the glass lower channel, and remove the glass with the front run.

INSTALLATION

1. Transfer the glass channel using the tool shown in Fig. 21.

2. Position the rollers and clips in the glass channel.

3. Place the glass assembly and front run in the window opening, and connect the regulator arms to the rollers in the glass channel.

4. Install the front run retainers.

5. Install the front and lower garnish mouldings.

6. Position the water shield and install the trim panel, lower retainer, arm rest, trim panel retaining screw, and the window regulator handle.

QUARTER WINDOW REGULATOR—MODEL 59

REMOVAL

1. Remove the quarter window handle.

2. Remove the ash tray and arm rest assembly.

3. Remove the screw retaining the rear edge of the trim panel, and then remove the trim panel lower retainer.

4. Unsnap the trim panel retaining clips and remove the trim panel.

5. Disconnect the regulator from the glass channel roller.

6. Raise the glass by hand and secure it in the raised position.

7. Remove the regulator retaining bolts, slide the regulator arm out of the equalizer and remove the regulator (Fig. 11).

INSTALLATION

1. Position the regulator inside the quarter panel, engage the arm in the equalizer, and install the regulator retaining bolts snugly.

2. Position the rollers in the glass channel, lower the glass and connect the regulator.

3. Check the operation of the glass, adjust if necessary, and tighten the retaining bolts.

4. Position the water shield, and install the trim panel, lower retainer, arm rest, trim panel retaining screw, and the window regulator handle.

QUARTER GLASS—MODEL 62

REMOVAL

1. Remove the rear seat cushion and back.

2. Remove the trim panel and position the water shield away from the access hole.

3. Remove the lower and front garnish mouldings.

4. Remove the rear run.

5. Lower the window until the regulator rollers are accessible, and disconnect the front roller from the channel.

6. Lower and tilt the glass as shown in Fig. 23, and remove it.

INSTALLATION

1. Transfer the channel, using the tool shown in Fig. 21.

2. Position the glass in the quarter panel, and connect the front rollers.

3. Install the rear run, adjusting it as necessary.

4. Install the garnish mouldings, position the water shield, and install the trim panel.

5. Install the seat cushion and back.

QUARTER WINDOW REGULATOR—MODEL 62

REMOVAL

1. Remove the rear seat cushion and back.

2. Remove the trim panel and position the water shield away from the access hole.

3. Disconnect the regulator from the glass channel roller.

4. Raise the glass by hand and secure it in the raised position.

5. Remove the regulator retaining bolts, slide the regulator arm out of the equalizer and remove the regulator (Fig. 10).

INSTALLATION

1. Position the regulator inside the quarter panel, engage the arm in the equalizer, and install the regulator retaining bolts snugly.

2. Position the rollers in the glass channel, lower the glass and connect the regulator.

3. Check the operation of the glass, adjust if necessary, and tighten the retaining bolts.

4. Position the water shield, and install the trim panel.

5. Install the seat cushion and back.

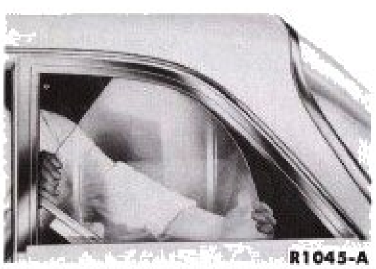

FIG. 23—Quarter Window Glass Removal—Body Type 62

QUARTER GLASS—MODEL 63

REMOVAL

1. Remove the rear seat cushion and seat back.

2. Remove the quarter window handle, arm rest, the quarter trim panel and position the water shield away from the access hole.

3. Disconnect the regulator arm from the glass channel.

4. Remove the upper rear stop retaining bolts and remove the upper rear stop.

5. Remove the lower stop retaining bolt and remove the lower stop.

6. Remove the retaining nut and two bolts from the front guide assembly.

7. Position the guide assembly in the bottom of the quarter panel and remove the glass and frame assembly (Fig. 12).

INSTALLATION

1. Remove the quarter window front weatherstrip retaining screw and remove the weatherstrip.

2. Remove the two retaining screws from the top front of the glass frame.

3. Remove the two retaining rivets from the rear of the glass frame.

4. Remove the glass lower channel and upper frame from the glass. Clean the channel and frame.

5. Install new glass tape and assemble the lower channel and upper frame to the glass.

6. Position the glass and frame assembly in the quarter panel by starting the assembly in the rear guide first, and then positioning the front guide assembly on the glass roller.

7. Position the front guide assembly and loosely install the retaining bolts and nut. **The window should be in the full down position.**

8. Connect the regulator arm to the glass lower channel and install the retaining clip.

9. Install the front weatherstrip and retaining screw.

10. Install the upper rear stop, the lower stop, and adjust the window assembly.

11. Position the water shield and install the garnish moulding, trim panel, regulator handle and arm rest.

12. Install the rear seat back and seat cushions.

QUARTER WINDOW REGULATOR—MODEL 63

REMOVAL

1. Remove the rear seat cushion and seat back.

2. Remove the quarter window handle, arm rest, quarter trim panel, and position the water shield away from the access hole.

3. Disconnect the regulator arm from the lower glass channel.

4. Raise the glass by hand and secure it in the raised position.

5. Remove the two bottom quarter window front guide retaining bolts.

6. Remove the regulator retaining bolts and remove the regulator out the access hole (Fig. 12).

INSTALLATION

1. Position the regulator in the quarter and install the retaining bolts snugly.

2. Install the two bottom quarter window front guide retaining bolts.

3. Lower the glass and connect the regulator arm to the glass channel.

4. Check the operation of the glass, adjust if necessary, and tighten the retaining bolts.

5. Position the water shield and install the quarter trim panel, regulator handle and arm rest.

6. Install the rear seat back and seat cushion.

QUARTER WINDOW FRONT GUIDE—MODEL 63

REMOVAL

1. Remove the rear seat cushion and seat back.

2. Remove the quarter window handle, arm rest, the quarter trim panel, trim panel retainer, garnish moulding, and position the water shield away from the access hole.

3. Remove the quarter window front guide lower retaining bolts and the adjuster screw lock nut.

4. Turn the adjuster screw to its full in position.

5. With the quarter glass in the lowered position remove the quarter window front guide from the glass channel rollers.

6. Remove the quarter window front guide through the access hole with the window glass in the up position (Fig. 12).

INSTALLATION

1. With the quarter glass in the up position, install the quarter window front guide into the glass channel rollers.

2. Install the quarter window front guide retaining bolts and adjuster screw lock nut snugly.

3. Check the operation of the glass, adjust if necessary, and tighten the retaining bolts and adjuster screw lock nut.

4. Position the water shield and install the garnish moulding, trim panel retainer, quarter trim panel, regulator handle, and arm rest.

5. Install the rear seat back and seat cushion.

QUARTER WINDOW REAR GUIDE—MODEL 63

REMOVAL

1. Remove the rear seat cushion and seat back.

2. Remove the quarter window handle, arm rest, quarter trim panel, trim panel retainer and garnish moulding, and position the water shield away from the access hole.

3. Position the rear seat back panel cardboard away from the seat back panel.

4. Remove the quarter window rear guide retaining bolt and adjuster screw lock nut, and remove the rear guide (Fig. 12).

INSTALLATION

1. Position the rear guide in the quarter and install the retaining bolt and adjuster screw lock nut snugly.

2. Check the operation of the glass, adjust, if necessary, and tighten the retaining bolt and adjuster screw lock nut.

3. Install the rear seat back panel card board.

4. Position the water shield, and install the garnish moulding, trim panel retainer, trim panel, regulator handle, and arm rest.

5. Install the rear seat back and seat cushion.

QUARTER GLASS—MODEL 76

REMOVAL

1. Remove the rear seat cushion and seat back.

2. Remove the quarter trim and position the water shield away from the access hole.

3. Remove the quarter window upper front and rear stops.

4. Disconnect the regulator arms from the lower glass channel and remove the quarter glass (Fig. 13).

INSTALLATION

1. Remove the glass upper frame and lower channel from the glass.

2. Install glass tape on the new glass, and install the upper frame and lower channel on the glass.

3. Position the quarter glass in the quarter and connect the regulator arms.

4. Install the quarter window upper front and rear stops and adjust the stops.

5. Position the water shield and install the quarter trim.

6. Install the rear seat back and seat cushion.

QUARTER WINDOW REGULATOR—MODEL 76

REMOVAL

1. Remove the rear seat cushion and seat back.

2. Remove the quarter trim and position the water shield away from the access hole.

3. Remove the quarter window upper front and rear stops.

4. Disconnect the regulator arms from the lower glass channel and remove the quarter glass.

5. Remove the regulator retaining bolts and remove the regulator (Fig. 13).

INSTALLATION

1. Position the regulator in the quarter and install the retaining bolts snugly.

2. Position the quarter glass in the quarter and connect the regulator arms.

3. Install the quarter window upper front and rear stops, adjust the stops and the window regulator, and tighten the retaining bolts.

4. Position the water shield and install the quarter trim.

5. Install the rear seat back and seat cushion.

QUARTER WINDOW FRONT GUIDE—MODEL 76

REMOVAL

1. Remove the rear seat cushion and seat back.

2. Remove the quarter trim and position the water shield away from the access hole.

3. Remove the quarter window upper front and rear stops.

4. Disconnect the regulator arms from the lower glass channel and remove the quarter glass.

5. Remove the quarter window front guide lower retaining bolt, the rear upper retaining nut, and the front adjuster screw lock nut.

6. Remove the quarter window front guide adjuster screw and position the window regulator arms to the top of their travel.

7. Remove the quarter window front guide from the quarter (Fig. 13).

INSTALLATION

1. Position the quarter window front guide in the quarter and install the adjuster screw.

2. Install the quarter window front guide lower retaining bolt, upper retaining nut and adjuster screw lock nut snugly.

3. Lower the regulator arms, position the quarter glass in the quarter and connect the regulator arms.

4. Install the quarter window upper front and rear stops, adjust the front guide, and tighten the guide retaining bolt and nuts.

5. Position the water shield and install the quarter trim.

6. Install the rear seat back and seat cushion.

QUARTER WINDOW REAR GUIDE—MODEL 76

REMOVAL

1. Unlatch the convertible top from the header and lower the top.

2. Remove the quarter window rear guide upper retaining nut.

3. Raise the convertible top and remove the guide lower retaining nut. Access for the lower retaining nut is gained through the top well boot.

4. Remove the quarter window rear guide (Fig. 13).

INSTALLATION

1. Position the rear guide in the quarter and install the lower retaining nut snugly.

2. Lower the convertible top and install the rear guide upper retaining nut snugly.

3. Check the operation of the quarter glass, adjust if necessary,

and tighten the rear guide retaining nuts.

4. Position the convertible top to the header and latch.

REAR QUARTER WINDOW AND/OR WEATHERSTRIP—MODELS 59, 71

REMOVAL

1. From inside the car, remove the quarter window front garnish moulding. Remove the window upper corner garnish moulding and the plug button from the rear pillar.

2. Remove the retaining nuts from the rear pillar outside moulding (Fig. 24) and remove the moulding. Remove the outside upper moulding retaining screw at the rear pillar.

3. Remove the window front pillar outside moulding retaining screws (Fig. 24).

4. Working from inside the car, loosen the weatherstrip from the opening flange, and push the window, weatherstrip, and mouldings out of the opening.

INSTALLATION

1. Remove the mouldings and weatherstrip from the glass.

2. Using solvent, clean the opening flange and the weatherstrip or glass. Apply a bead of caulking cord to the window opening.

3. Apply sealer in the weatherstrip groove for the glass and position the weatherstrip on the glass. Install the outside mouldings in the weatherstrip.

4. Position a draw cord in the weatherstrip and apply Ru-Glyde to the weatherstrip surfaces that will contact the window opening flange.

5. Position the window in the opening, and with a helper applying pressure from the outside, use the draw cord to pull the lip of the weatherstrip over the opening flange.

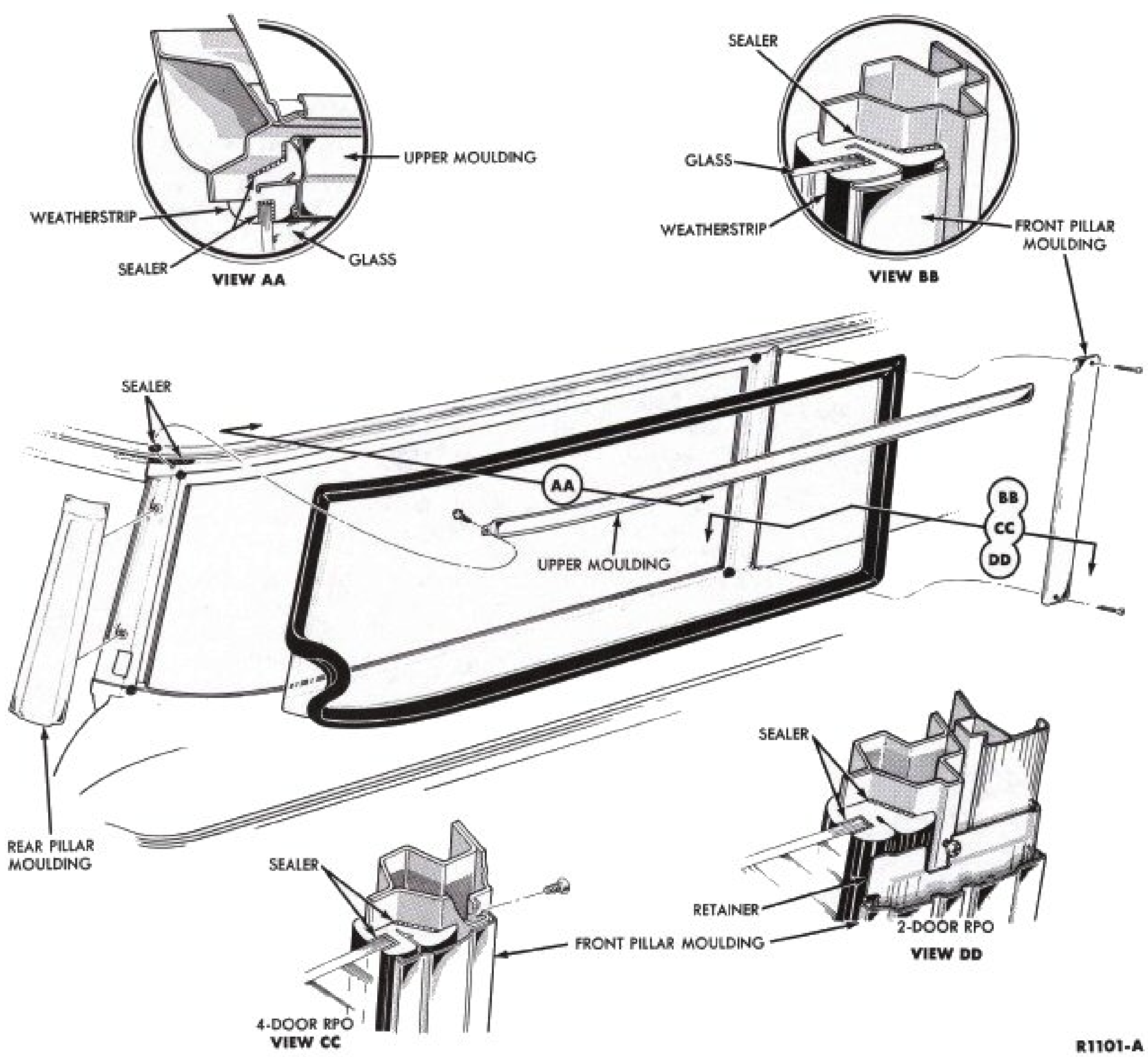

FIG. 24—Stationary Rear Quarter Window—Body Types 59, 71

6. Install the outside upper moulding retaining screw, rear pillar moulding, plug button, and upper corner garnish moulding.

7. Install the quarter window front garnish moulding.

8. Install the window outside front pillar moulding.

WINDSHIELD AND/OR WEATHERSTRIP

REMOVAL

1. Remove the windshield wiper arms and blades.

2. Tape the roof panel at the upper corners to prevent scratching, and remove the moulding joint covers (Fig. 25) for all models except 63 and 76. The covers are retained by a snap fit.

3. On a convertible, lower the top.

4. Remove the top moulding corner retaining screws for all models except 63 and 76.

5. Remove the windshield outside mouldings.

6. Remove the windshield outside top moulding retaining clips for model 63.

7. Remove the sun visors and the windshield inside garnish mouldings.

8. Remove the inside rear view mirror.

9. Push outward along the edges of the windshield and remove the windshield with the weatherstrip and the outside lower moulding and/or upper moulding (Figs. 27, 28 and 29).

INSTALLATION

1. Remove the outside moulding or mouldings and the weatherstrip from the glass.

FIG. 25—Moulding Joint Cover—Body Types Except 63, 76

2. Clean the glass or the weatherstrip and the body opening flange.

3. Using a sealer gun, apply sealer in the weatherstrip glass opening.

4. Position the weatherstrip on the glass, and then install the moulding or mouldings in the weatherstrip.

5. Insert the draw cord in the weatherstrip (Fig. 26), and apply Ru-Glyde to the weatherstrip surfaces that will contact the windshield opening flange.

6. Using a sealer gun, apply a bead of sealer completely around the windshield opening.

7. Position the window assembly in the body opening. With a helper applying hand pressure from the outside, use the draw cord to pull the lip of the weatherstrip over the window opening lower flange, each side flange, and then over the upper flange.

8. Install the windshield outside top moulding retaining clips for model 63.

9. Install the retaining screws in the windshield outside top moulding corners for all models except 63, 76.

10. Install the windshield outside mouldings (Figs. 27, 28 and 29).

11. Install the windshield wiper arms and blades.

12. Install the sun visors and windshield inside garnish mouldings.

13. Install the inside rear view mirror.

14. Check the windshield for leaks, and clean the windshield and mouldings.

15. On a convertible, raise the top.

BACK WINDOW AND/OR WEATHERSTRIP—MODELS 54, 62, 63

REMOVAL

1. From inside the car, loosen the weatherstrip edges, and then push out the back window, weatherstrip and exterior mouldings as an assembly (Figs. 30 and 31).

INSTALLATION

1. Remove the mouldings from the weatherstrip (Figs. 30 and 31).

2. Remove the weatherstrip from the glass.

3. Clean the glass or weatherstrip and the body opening flange.

4. Using a sealer gun, apply sealer in the weatherstrip glass opening.

5. Position the weatherstrip on the glass, and then install the mouldings in the weatherstrip.

6. Insert the draw cord in the weatherstrip, and apply rubber lubricant to the weatherstrip surfaces that will contact the back window opening flange (Fig. 26).

7. Using a sealer gun apply a bead of sealer completely around the back window opening.

8. Position the window assembly in the body opening. With a helper applying hand pressure from the outside, use the draw cord to pull the lips of the weatherstrip over the window opening flanges.

9. Check the back window for leaks and clean the back window and mouldings.

TAILGATE GLASS

REMOVAL

1. Open and temporarily support the tailgate.

2. Disconnect the tailgate hinge supports at the tailgate.

3. Remove the tailgate cover panel retaining screws and remove the panel.

4. Remove the window regulator arm roller retaining pins, disconnect the arms from the rollers, and remove the rollers from the glass channel.

5. Remove the window from the tailgate.

INSTALLATION

1. With a glass remover tool, remove the glass lower retainer and channel, and weatherstrip.

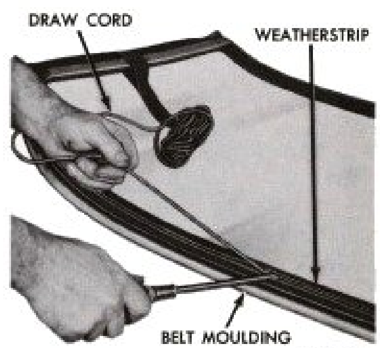

FIG. 26—Draw Cord Installation

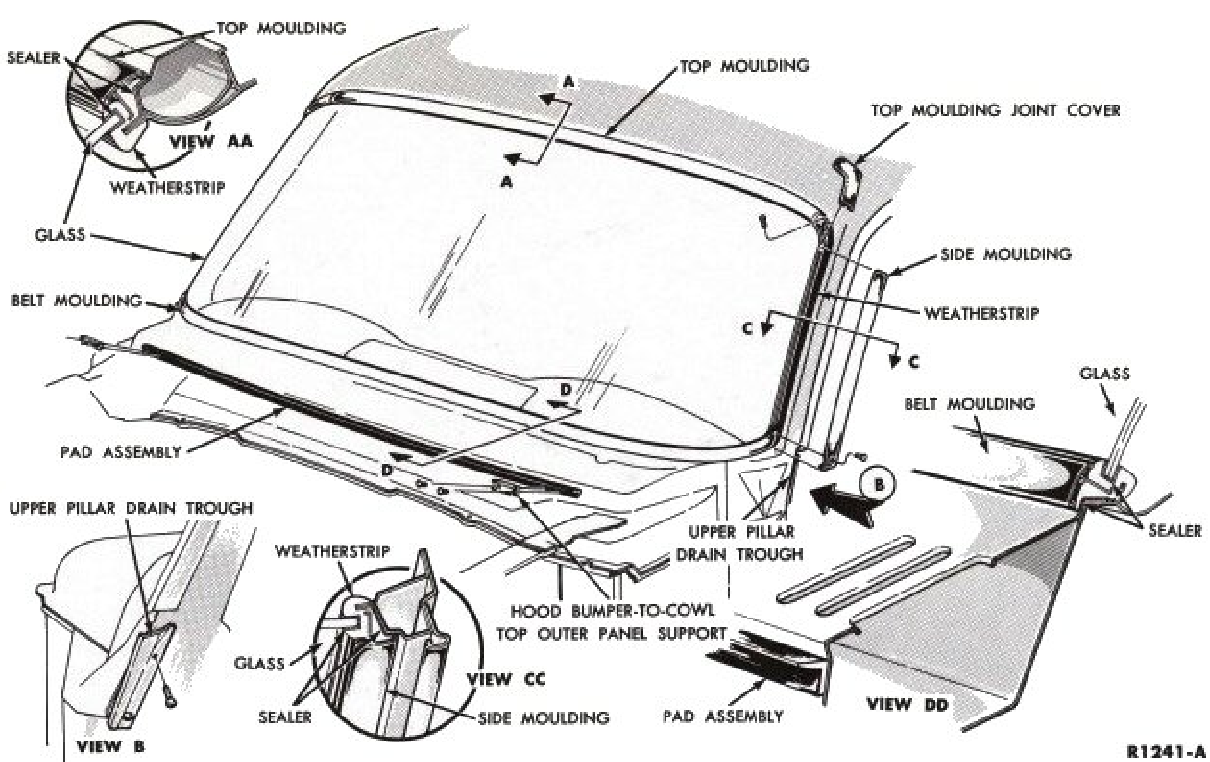

FIG. 27—Windshield Installation—Body Types Except 63, 76

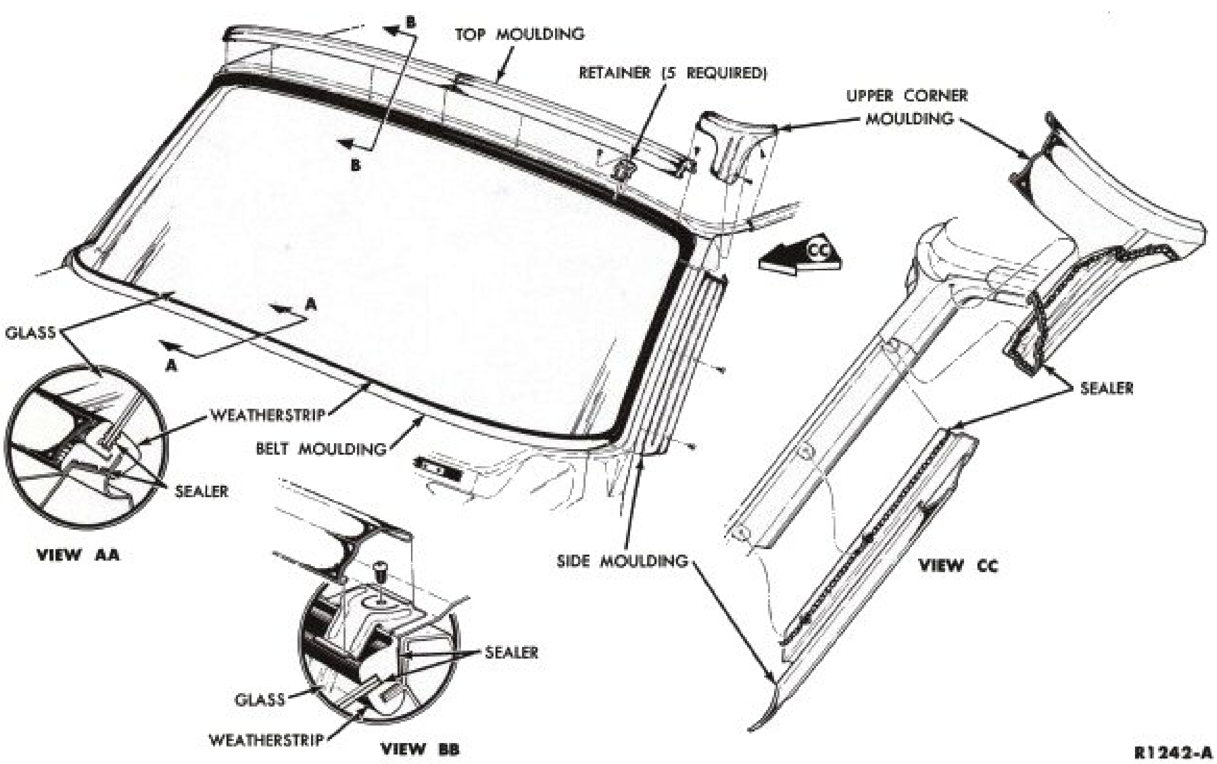

FIG. 28—Windshield Installation—Body Type 63

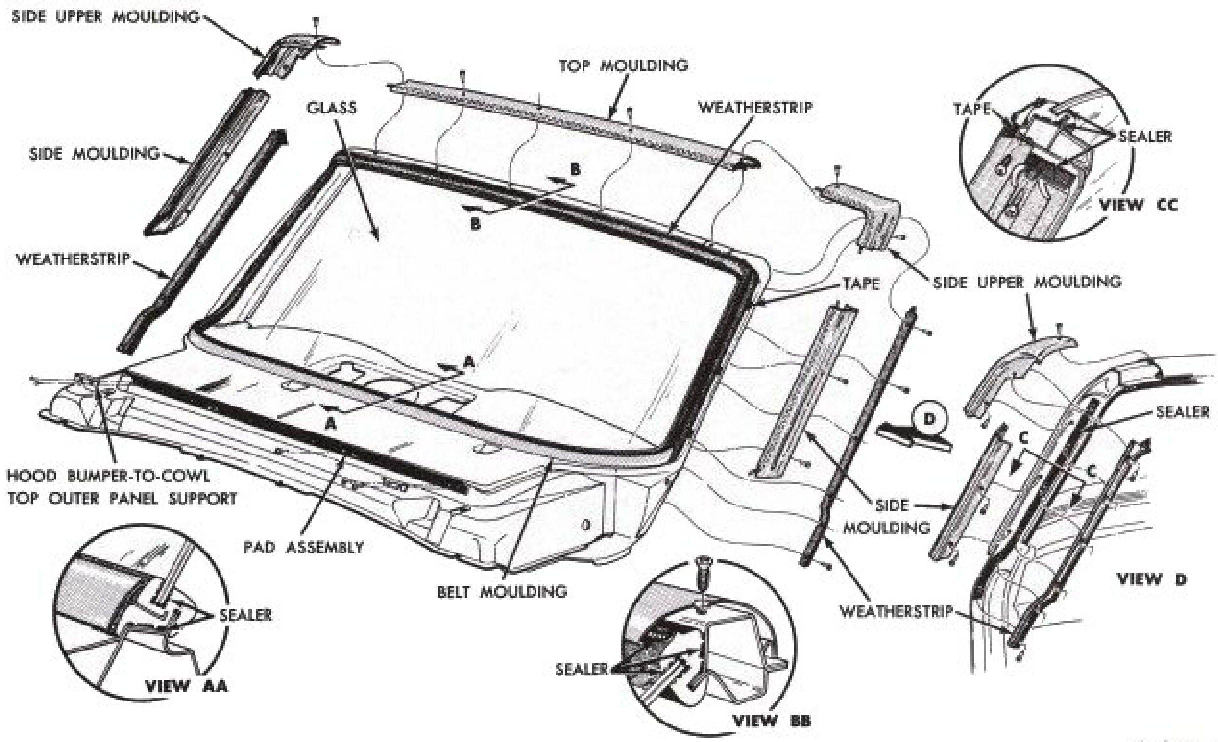

FIG. 29—Windshield Installation—Body Type 76

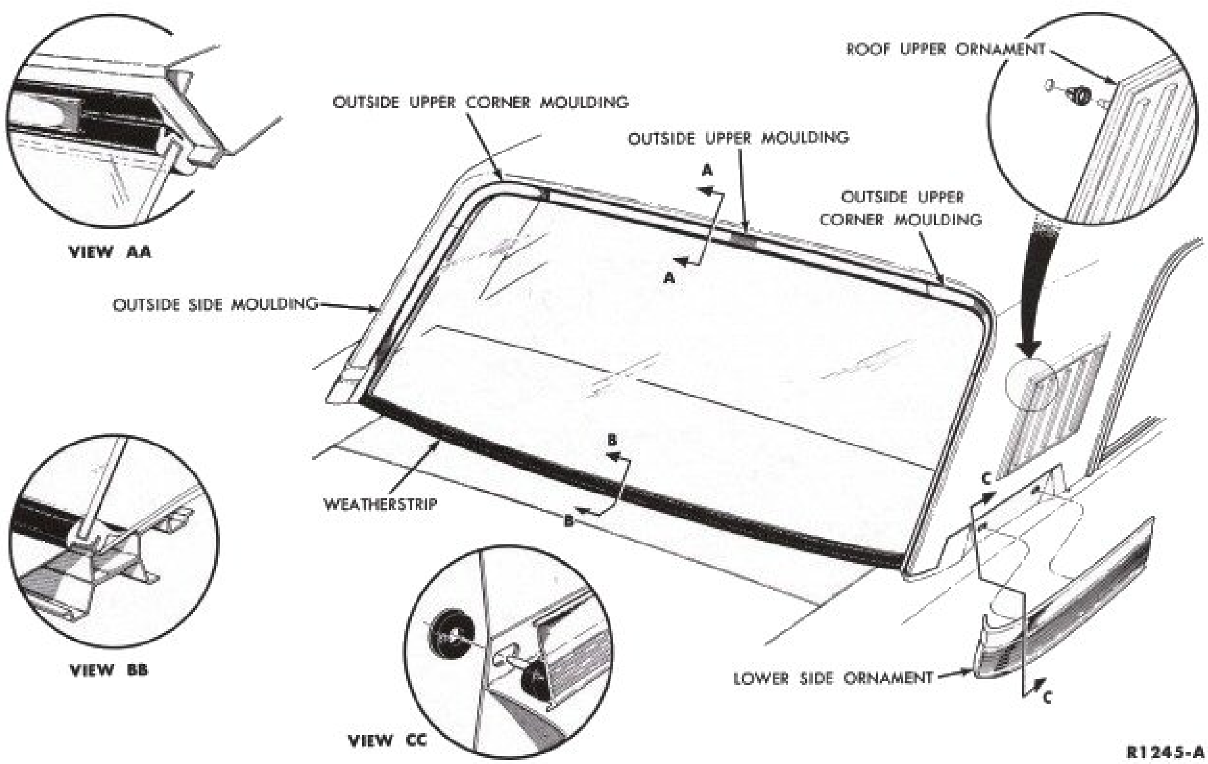

FIG. 30—Back Window Installation—Body Type 54, 62

2. Remove the weatherstrip from the glass lower retainer and channel assembly, and then clean the glass groove.

3. Position the weatherstrip into the glass lower channel. Install the weatherstrip and channel to the glass.

4. Slide the window assembly into the glass runs and connect the regulator arms and rollers to the glass lower channel.

5. Apply Lubriplate to the glass rollers.

6. Clean the old sealer from the tailgate cover panel and apply new sealer.

7. Install the tailgate cover panel to the tailgate.

8. Connect the tailgate hinge supports and remove the temporary support.

TAILGATE WINDOW REGULATOR—MANUAL

REMOVAL

If the tailgate window regulator mechanism should fail with the window in a partially closed or closed position, the tailgate can be opened by removing the window side and upper runs (Fig. 32).

1. Open and temporarily support the tailgate.

2. Disconnect the tailgate hinge supports at the tail gate.

3. Remove the tailgate cover panel retaining screws and remove the panel.

4. Remove the window regulator arm roller retaining pins, disconnect the arms from the rollers, and remove the rollers from the glass channel.

5. Remove the tailgate window from the tailgate and scribe the regulator mounting location.

6. Remove the regulator retaining bolts and remove the regulator.

INSTALLATION

1. Place the regulator manual drive spline into the handle, align the regulator, and install the regulator retaining bolts.

Install the window assembly in the tailgate.

2. Clean the old sealer from the tailgate cover panel and apply new sealer.

3. Install the tailgate cover panel to the tailgate.

4. Connect the tailgate hinge supports and remove the temporary support.

TAILGATE WINDOW REGULATOR—POWER

REMOVAL

If the tailgate window regulator mechanism should fail with the window in a partially closed or closed position, the tailgate can be opened by removing the window side and upper runs (Fig. 32).

1. Open and temporarily support the tailgate.

2. Disconnect the tailgate hinge supports at the tailgate.

3. Remove the tailgate cover panel retaining screws and remove the panel.

4. Remove the window regulator arm roller retaining pins, disconnect the arms from the rollers, and remove the rollers from the glass channel.

5. Remove the window from the tailgate.

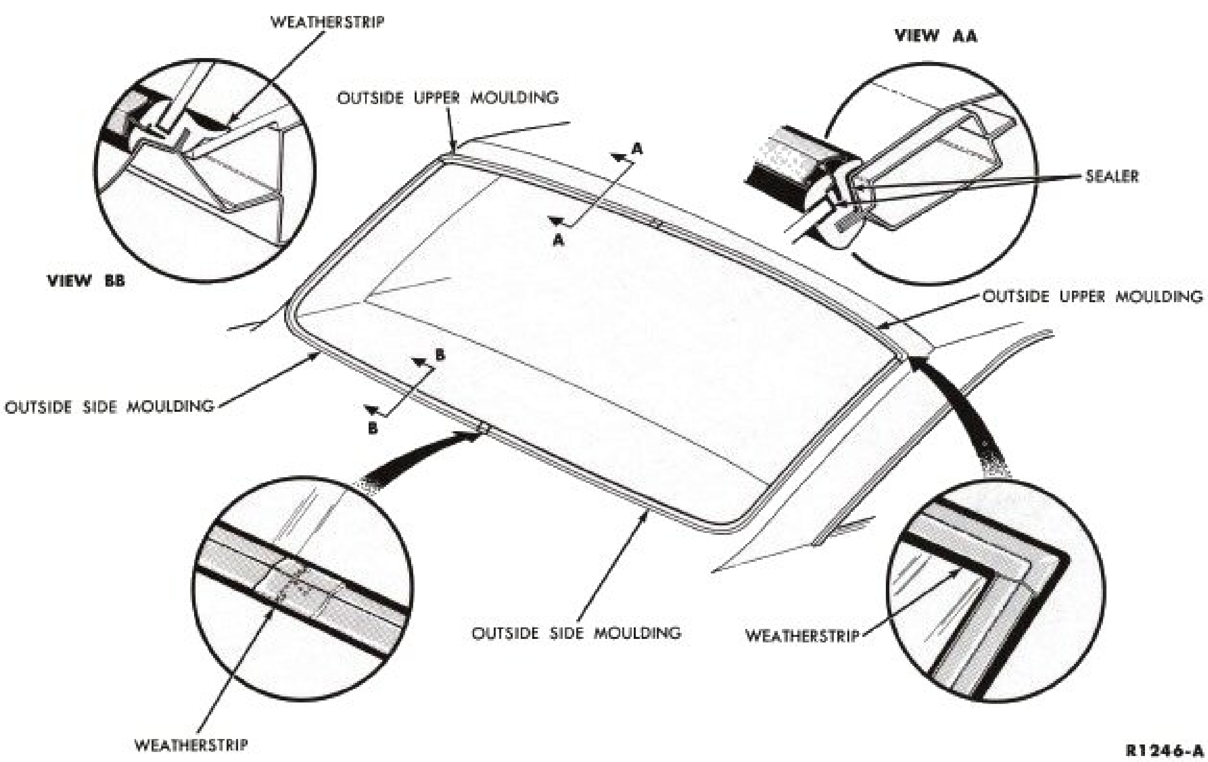

FIG. 31—Back Window Installation—Body Type 63

6. Disconnect the motor leads from the wiring harness in the tailgate.

7. Scribe the regulator mounting location, remove the regulator retaining bolts, and remove the regulator with the motor attached.

INSTALLATION

1. Do not remove the electric regulator drive assembly for transfer to the new regulator until the regulator counterbalance spring is unloaded. To unload the regulator counterbalance spring, place the spring in a vise so that the spring can not unwind, disconnect the spring from the outer retaining tab, and then slowly loosen the vise jaws.

2. Remove the screws retaining the regulator drive assembly and the motor to the regulator and remove the drive assembly and motor.

3. Position the drive assembly and motor to the new regulator and install the retaining screws.

4. Drill out the rivets retaining the manual clutch gear and housing assembly to the regulator. Remove and discard the manual drive assembly. **The manual clutch and gear assembly should not be removed until the electric drive assembly is installed.**

5. Install the regulator assembly on the tailgate and align the regulator as required.

6. Connect the wiring harness to the motor and secure the harness in place with the retainer.

7. Install the window assembly into the tailgate.

8. Apply Lubriplate to the glass rollers.

9. Clean the old sealer from the tailgate cover panel and apply new sealer.

10. Install the tailgate cover panel to the tailgate.

11. Connect the tailgate hinge supports and remove the temporary support.

TAILGATE SWITCH AND LOCK CYLINDER—POWER

REMOVAL

1. Open and temporarily support the tailgate.

2. Disconnect the tailgate hinge supports at the tailgate.

3. Remove the tailgate cover pan-

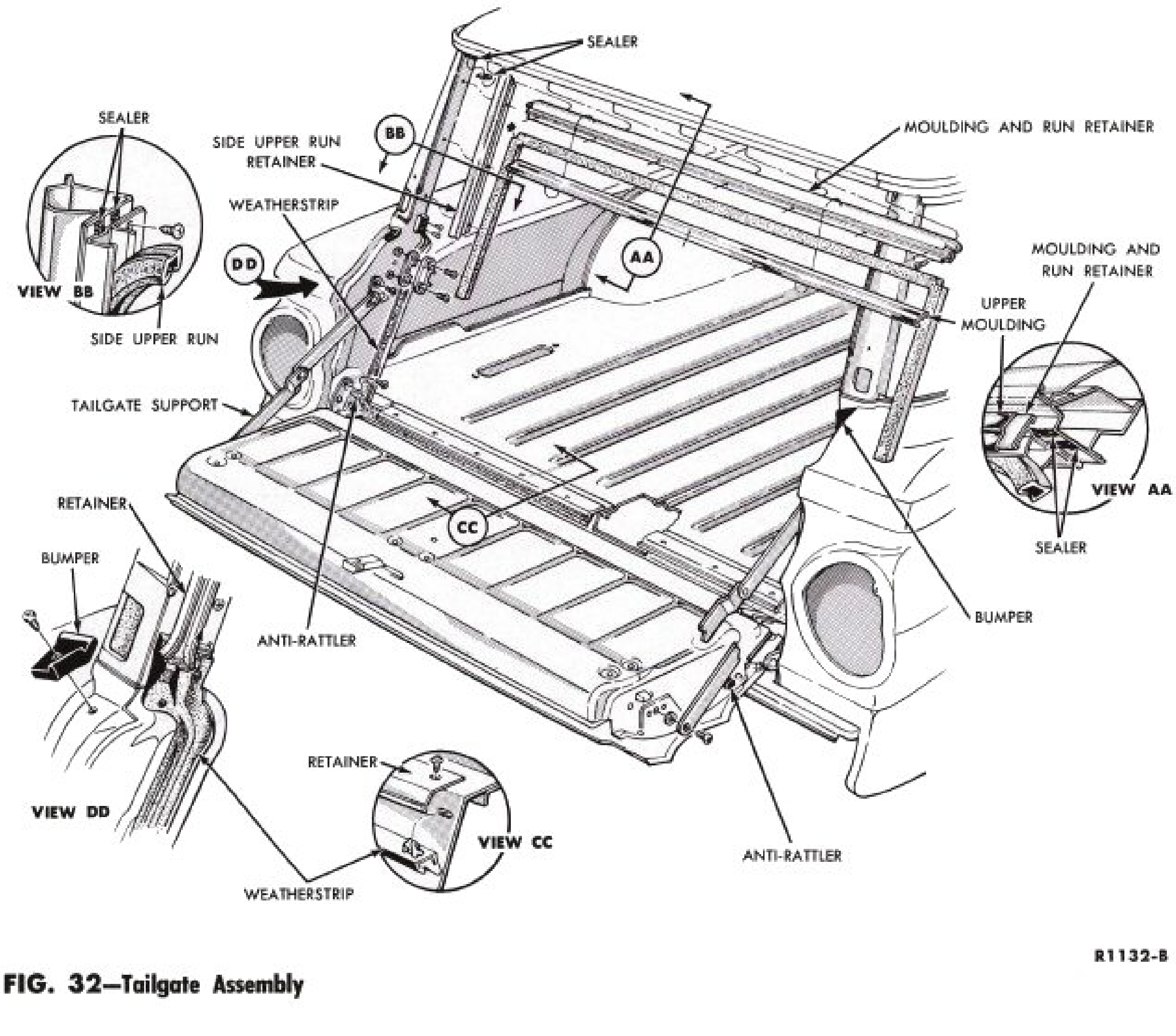

FIG. 32—Tailgate Assembly

el retaining screws and remove the panel.

4. Remove the window regulator arm roller retaining pins, disconnect the arms from the rollers, and remove the rollers from the glass channel.

5. Remove the window from the tailgate.

6. Remove the regulator.

7. Remove the nuts retaining the lock and switch, and then remove the lock and lock cylinder from the tailgate (Fig 33).

8. If the switch requires replacement, disconnect the switch wires from the tailgate wiring harness and remove the switch and wires.

9. To remove the lock cylinder, depress the lock cylinder retaining pin, insert the key and rotate the cylinder until the retaining pin drops, and then remove the lock cylinder.

INSTALLATION

1. To install the lock cylinder, insert the key in the lock cylinder and slide the cylinder into the retainer.

2. To install the switch assembly, route the wiring harness through the tailgate to the tailgate harness switch connector.

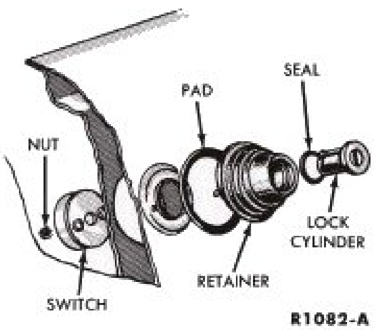

FIG. 33—Tailgate Switch and Lock—Power

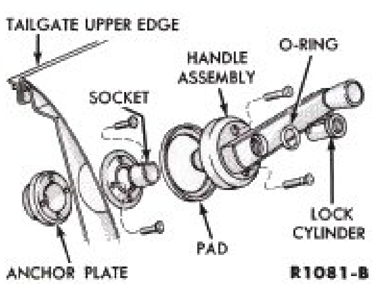

FIG. 34—Tailgate Window Regulator Handle—Manual

3. Place the lock assembly and gasket to the tailgate and position the switch to the lock assembly. It may be necessary to rotate the lock cylinder to align the switch and the lock. Install the retaining nuts.

4. Install the window regulator.

5. Install the tailgate window assembly into the tailgate.

6. Apply Lubriplate to the glass rollers.

7. Clean the old sealer from the tailgate cover panel and apply new sealer.

8. Install the tailgate cover panel to the tailgate.

9. Connect the tailgate hinge supports and remove the temporary support.

TAILGATE WINDOW HANDLE AND LOCK CYLINDER—MANUAL

REMOVAL

1. With the tailgate window in the closed position, unlock the tailgate handle, and rotate the handle assembly to reveal the mounting screws (Fig. 34).

2. Remove the handle mounting screws, and then remove the handle assembly and pad.

3. To remove the lock cylinder turn the key in the cylinder to align the cylinder locking pin with the access hole in the handle assembly. Depress the locking pin and remove the lock cylinder.

INSTALLATION

1. To replace the lock cylinder, transfer the O-rings, and then with the key in the cylinder, install the lock cylinder in the handle assembly.

2. If the window regulator has been replaced, it may be necessary to reposition the handle assembly so that it hangs in a vertical position, with the tailgate window in a closed position. To adjust the handle position, remove the snap ring and socket from the window regulator stem, and then install the socket with the notch at the top.

3. Install the pad and handle assembly.

LATCH RELEASE LEVER AND LINK

REMOVAL

1. Support the tailgate, and remove the bolt and washer retaining the hinge support to the tailgate.

2. Remove the tailgate cover panel retaining screws and remove the panel.

3. Remove the retaining screws from the right or left latch assembly, rotate the latch 90 degrees, and remove the latch (Fig. 35).

4. Pull the knob from the tailgate latch release lever.

5. Remove the latch release lever retaining screws and remove the lever and link.

INSTALLATION

1. Connect the link to the latch on the tailgate, position the release lever on the tailgate, and install the retaining screws.

2. Install the knob on the latch actuating lever.

3. Install the latch.

4. Remove the old sealer from the cover panel and apply new sealer.

5. Install the cover panel to the tailgate.

6. Connect the tailgate hinge supports and remove the temporary support.

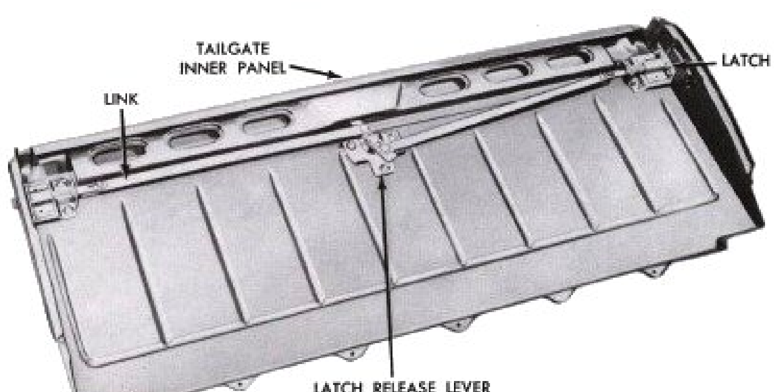

FIG. 35—Latch Release Lever Assembly

TAILGATE HINGE

REMOVAL

1. Support the tailgate in the open position.

2. Disconnect both hinge supports at the tailgate.

3. Remove the screws retaining the tailgate cover panel assembly to the tailgate and remove the cover panel.

4. Crank the window regulator enough to gain access to the hinge area. Remove the hinge to cover seal.

5. Insert a screwdriver into the tailgate counterbalance spring strap to prevent the strap hook from entering the spring compartment when the hinge is removed.

6. Loosen the lock nut on the tailgate glass run lower adjusting screw to provide clearance for the removal of the hinge upper retaining bolt.

7. Partially close the tailgate and remove the hinge to tailgate retaining bolts, strap hook, and hook retainer plate.

8. Pull off the tailgate support anti-rattle pad.

9. Scribe the hinge location to the body and remove the screws retaining the hinge. Pull the tailgate slightly away from the body and remove the hinge.

INSTALLATION

1. Position the hinge on the tailgate and snugly install the hinge retaining screws to the body.

2. With the tailgate partially closed, install the tailgate counterbalance spring strap hook and hook retainer plate to the hinge.

3. Remove the screwdriver from the spring strap.

4. Tighten the tailgate glass run lower adjusting screw.

5. Lower the glass and check and adjust the tailgate alignment. Tighten the hinge retaining screws and bolts (Fig. 36).

6. Install the tailgate support anti-rattle pad and the hinge to cover seal.

7. Clean off the old sealer from the cover panel and apply new sealer.

8. Install the inner panel to the tailgate.

9. Install the tailgate hinge supports and remove the temporary support.

TAILGATE COUNTERBALANCE SPRING

REMOVAL

1. Remove the spring access cover (Fig. 37).

2. From inside the vehicle and with the tailgate in the closed position, insert a 12-inch screwdriver through the hooked end of the spring and into the hole provided in the member, and unhook the spring from the retaining pin (Fig. 37).

3. Unhook the spring from the tailgate strap and remove the spring.

4. Remove the strap from the counterbalance spring strap hook.

INSTALLATION

1. Position the strap on the hook.

2. Position the spring in the spring compartment and connect it to the strap.

3. With a long screwdriver and the tailgate in the closed position, hook the spring to the retaining pin.

4. Clean the old sealer from the access cover and floor pan.

5. After applying new sealer, install the access cover.

DECK LID

REMOVAL

New deck lids are furnished in prime paint without hardware. All usable hardware parts should be removed from the old deck lid so they can be installed in the new one.

Before the old deck lid is removed and disassembled, time will be saved if the new one is prepared for installation. Inspect the new lid for dings and other minor damage, repair as necessary, and sand and paint it. While it is drying, remove and disassemble the old lid. When the new lid is dry, install the hardware.

1. Remove all serviceable hardware.

FIG. 36—Tailgate Hinge Adjustments

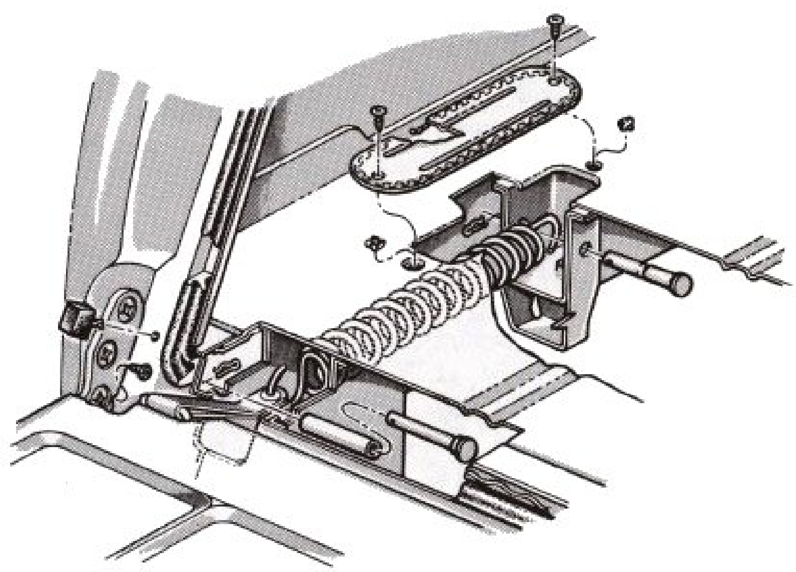

FIG. 37—Tailgate Counter-Balance Spring

2. Remove the hinge attaching bolts from the deck lid, and lift it off the hinges.

INSTALLATION

1. Position the lid and install the attaching bolts loosely.

2. Close the lid gently to check the fit.

3. Adjust the deck lid and hinges for proper fit.

4. Adjust the striker plate.

DECK LID HINGE OR TORSION BAR

REMOVAL

1. Prop the deck lid open.

2. Mark the hinge position on the lid and on the mounting bracket for reference when a new hinge is installed.

3. Using a tool T64P-44890-A, pry the anchor end of the torsion bar out of its adjustment notch (Fig. 38). Lower the deck lid and from inside the luggage compartment remove the bar. Prop the deck lid open.

4. Position a cover under the hinge edge of the deck lid to prevent paint damage. Remove the hinge attaching bolts from the deck lid and from the mounting bracket, and remove the hinge.

INSTALLATION

1. Position the hinge, and partially tighten the mounting bolts.

2. Remove the protective cover and install the torsion bar, reversing the procedure in step 3 above. The farther rearward the anchor end is twisted, the greater the tension.

3. Remove the prop and check the lid position. After any necessary adjustment, tighten the hinge attaching bolts.

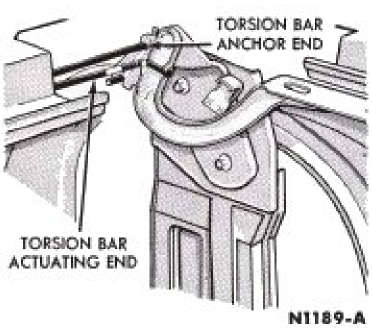

FIG. 38—Deck Lid Torsion Bar

DECK LID LOCK

REMOVAL AND INSTALLATION

1. Unlock and open the deck lid.

2. Remove the bolts retaining the lock assembly and remove the lock.

3. Position the lock assembly to the deck lid and loosely install the retaining bolts.

4. Adjust the lock assembly and tighten the bolts.

DECK LID LOCK CYLINDER

REMOVAL

1. Open the deck lid and remove the lock assembly and the door lock extension.

2. Remove the sleeve assembly retaining nut, lock washer, spacer, and sleeve and cylinder (Figs. 39 and 40).

3. To remove the lock cylinder from the sleeve assembly, turn the key in the cylinder ⅛ turn clockwise from the locked position, depress the cylinder retaining pin, and remove the key and cylinder.

INSTALLATION

1. To install the lock cylinder turn the key in the cylinder ⅛ turn clockwise from the locked position and insert the cylinder into the sleeve assembly.

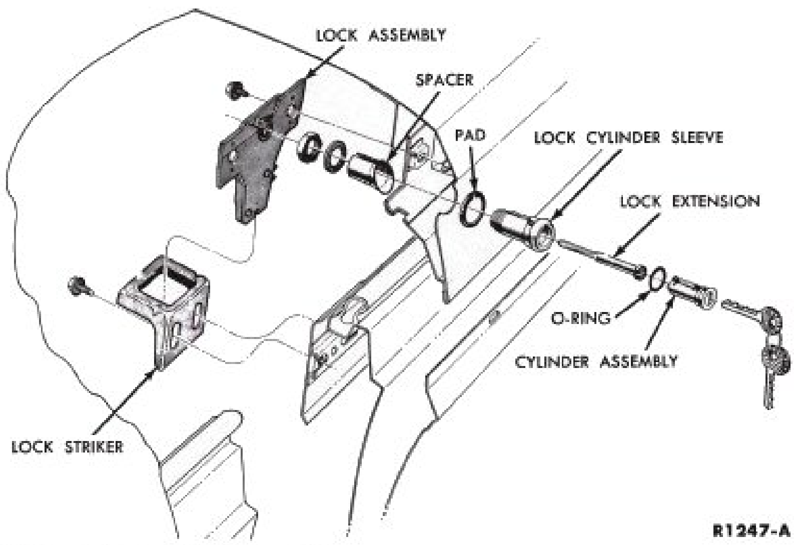

FIG. 39—Deck Lid Lock—Falcon

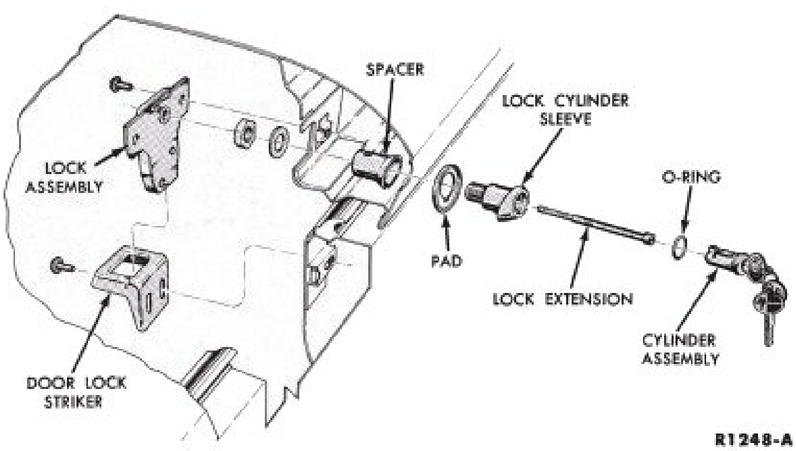

FIG. 40—Deck Lid Lock—Comet

2. Position the sleeve assembly spacer, and washer to the deck lid door and install the retaining nut.

3. Position the door lock extension, install the lock assembly and adjust.

INSIDE REAR VIEW MIRROR (BONDED TO WINDSHIELD)

REMOVAL

1. Clean both the inside and outside surfaces of the windshield in the area of the mirror mounting bracket. Inspect the windshield for stone chips and scratches.

2. Using welding putty or wet rags, insulate all chips or scratches within 12 inches of the mirror mounting bracket.

3. Apply heat to the bracket mounting area from outside the windshield with a standard 250 watt infrared bulb (heat lamp). Hold the lamp approximately 4 inches from the windshield, and rotate it in a small circle.

4. The mirror mounting bracket can be pulled off the windshield glass in approximately 8-10 minutes using the mirror as a handle.

5. Slowly remove the heat lamp. **Do not remove the insulating materials until the windshield has cooled to room temperature.**

6. Remove the mirror and arm from the bracket.

INSTALLATION

1. Locate and mark with a wax pencil the bracket location on the outside surface of the windshield (Fig. 41).

2. Use a good grade of "Ethyl Alcohol" to thoroughly clean the inside glass surface bracket mounting area and mounting bracket face. It is important that the mounting surfaces are properly cleaned before the resin is applied.

3. To mix the resin pour the entire contents of the small catalyst bottle into the large epoxy bottle (Fig. 41).

4. Stir the contents for 3 to 5 minutes.

To guarantee the correct mixing ratio and resulting bond strength it is mandatory that the entire contents of both bottles are used and properly mixed. Under no circumstances should only portions of the epoxy or catalyst be used.

5. Apply the mixed resin to the bracket mounting surface. Level off the resin film as smoothly as possible.

6. Place the mounting bracket surface upward in a vise or in a small mound of permagum or any suitable holding material that will support the mounting bracket (Fig. 41). Hold a standard 250 watt infrared lamp about 5 to 6 inches from the mounting surface of the bracket for 2½ minutes.

7. Allow the bracket to cool for one minute. With light hand pressure apply the mounting surface of the bracket to the desired inside area of the windshield.

8. Secure the bracket to the windshield using a piece of tape about 5 inches long located just under the knob of the bracket (Fig. 41). Apply another piece of tape in the vertical direction (Fig. 41) to firmly hold the mounting bracket in place on the windshield.

9. When the temperatures are above 67°F., the mirror and arm should not be mounted to the bracket for 8 hours, to allow the resin to properly adhere the bracket to the glass. However, the car may be used with the bracket taped in place one hour after installation.

When the temperatures are below 67°F., the mirror and arm should not be mounted to the bracket for 16 hours. However, the car can be used 2 hours after the bracket has been taped in place.

10. After the bracket has had time to adhere to the glass, remove the tape and install the mirror and arm to the bracket (Fig. 41).

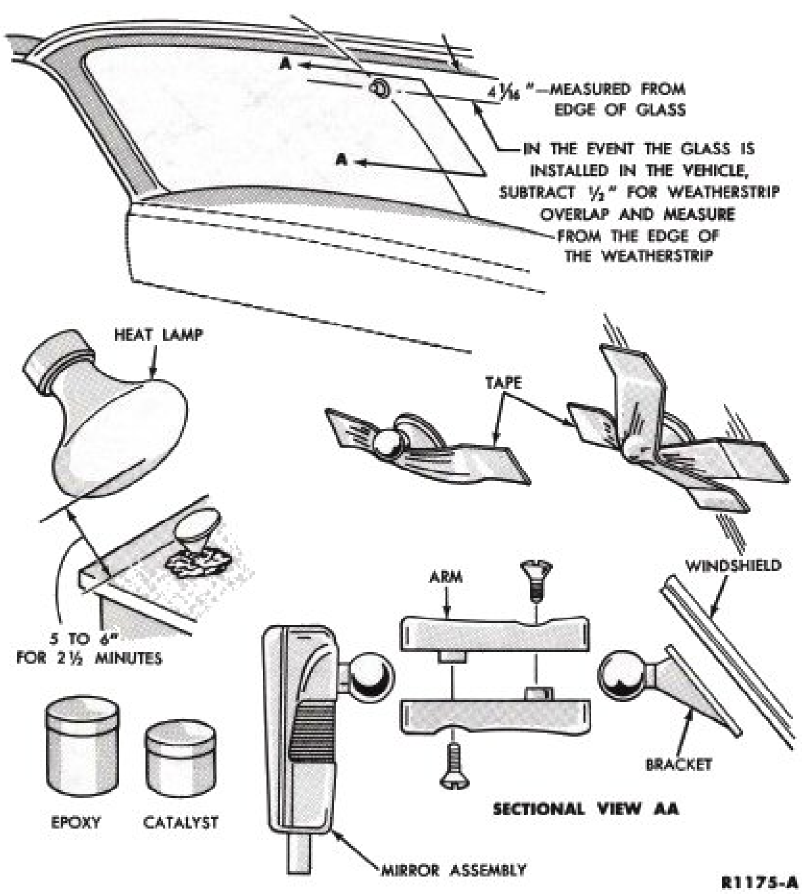

FIG. 41—Bonded Rear View Mirror Installation

TRIM, SEATS, AND CONVERTIBLE TOP

GROUP 18

PART 18-1 INTERIOR TRIM AND LANDAU TOP COVER

1 DOOR AND QUARTER TRIM PANELS

REMOVAL AND INSTALLATION

Basically, all door and quarter trim panels are retained in the same manner. In view of this, one removal and installation procedure will cover all models.

1. Remove the window regulator handle with the tool shown in Fig. 1. **Insert the tool between the control handle and the friction plate.** Press the tool against the spring clip until the handle can be released from the shaft.

2. Remove any screws retaining the trim panel to the inner panel, such as the arm rest retaining screws (Fig. 2). To reveal the quarter panel arm rest forward retaining screw, slide the ash tray assembly forward.

3. With a putty knife, pry the trim panel retaining clips out of the inner panel at each side.

4. Bow the trim panel out of the retainers, and carefully loosen the plastic water shield, if necessary.

5. Place a daub sealer over each trim retaining clip hole to seal the retaining clips when they are pushed into the door. Also, apply this sealer around the window regulator shaft and other existing holes.

6. Fasten the plastic water shield to the inner panel with C2AZ-19C-525-A cement (Figs. 3 and 4).

7. Make sure all the retaining clips

FIG. 1—Typical Handle Removal

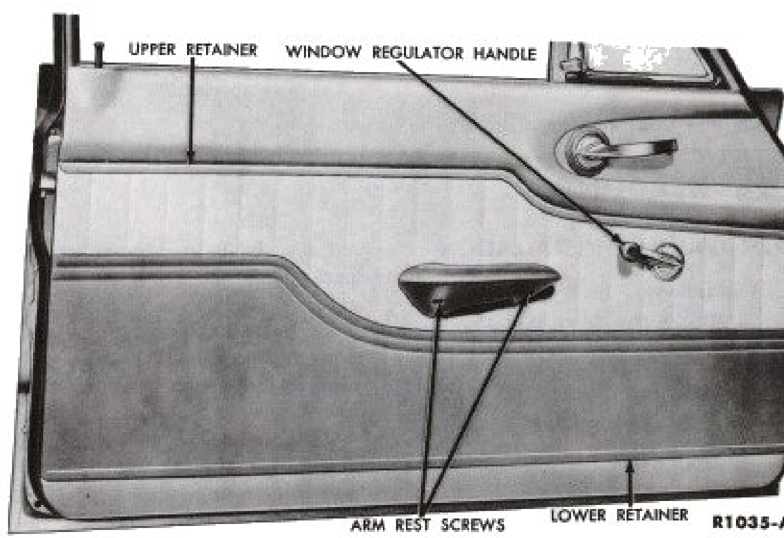

FIG. 2—Typical Door Trim

are installed in the trim panel. Position the spring on the regulator handle shaft. Place the upper edge of the trim panel in the retainer, bow the trim panel, and then insert the lower edge into the retainer. Push retaining clips into the holes in the door inner panel.

8. Install the arm rest retaining screws.

9. Insert the spring clip in the handle, place the friction plate against the trim panel and push the handle onto the shaft until the spring clip snaps into the groove.

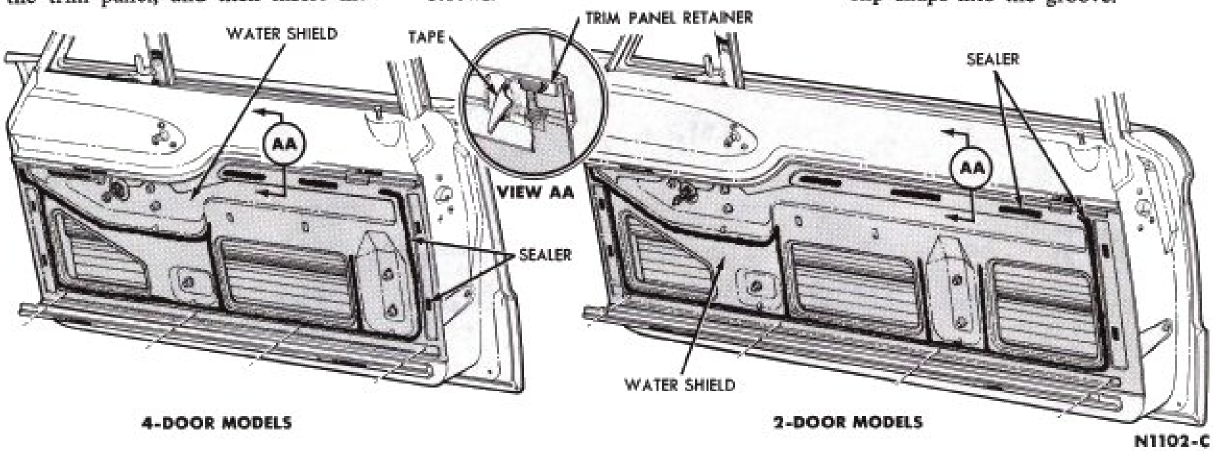

FIG. 3—Door Water Shields

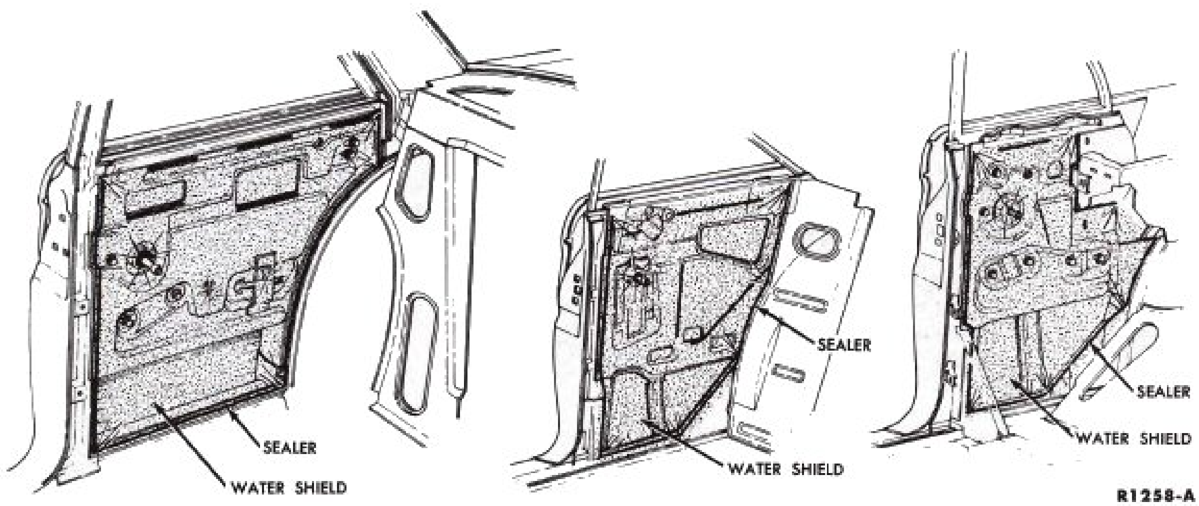

FIG. 4—Quarter Water Shields

2 HEADLINING

REMOVAL AND INSTALLATION

The following headlining replacement procedure applies to all models in general. If some of the steps in these procedures do not apply to the particular model being serviced, proceed to the next step (Figs. 5 and 6).

1. Remove the windshield garnish mouldings, sun visor assemblies, dome lamp lens, and rear view mirror.

2. Remove the rear seat cushion and seat back to provide working space. Slide the package tray out from the back window weatherstrip and remove it from the shelf. Remove the coat hooks, center pillar garnish mouldings, and quarter window garnish mouldings.

On the station wagon, remove the plug button and the corner garnish moulding from the rear pillar. Remove the nuts which retain the pillar outside moulding studs to the pillar and remove the pillar outside mouldings. From inside the car, remove the side and upper runs from the pillar and the roof rails.

On the hardtop, remove the door opening windlace assemblies from the roof rail side.

3. Cut the headlining along the edge of the windshield, back window, and stationary window weatherstrips. Disconnect the headlining along the side rails, and then starting at the front of the car, push the ends of the roof bows out of the roof side

rails. At the rear bow, release the two rear bow retainers from the roof rear rail, and then remove the headlining.

4. Check the tabs on the headlining side retaining strips. If any tabs are bent or flattened, repair them and tighten the retaining strips.

5. Transfer the headlining bows in sequence to the new headlining.

Roof bows are color coded at each end. When ordering new roof bows, be sure to note the color at each end of the bow.

6. Install the rear bow in the side rails, and connect the rear bow retainers to the roof rear rail. Install the other headlining bows, working from the rear toward the front of the car. The headlining should be centered and the seams straight.

7. Apply trim cement to the windshield header along the edge of the windshield weatherstrip. Cement the headlining to the windshield header, starting from the center. Trim the headlining approximately ½ inch below the windshield weatherstrip edge and then install the headlining under the windshield weatherstrip.

On the hardtop, staple the headlining to the header corners and position over the retainer tabs.

8. Apply trim cement to the back window upper frame along the edge of the window weatherstrip.

On a station wagon, apply trim cement to the tailgate window upper run mounting area.

Cement the headlining in place, starting from the center.

9. Trim the headlining around the back window. On the sedan and Ranchero models, trim the headlining approximately ½ inch below the back window weatherstrip edge. Place the headlining under the back window weatherstrip.

10. Pull the headlining down at the sides to remove the wrinkles. Cut the headlining bow retainers to eliminate gathering of the material. Trim the headlining at the door openings to approximately 1½ inches below the windlace. Starting at the front on each side of the car, use a putty knife (with rounded corners) to work the headlining up under the retaining strip. Be sure the headlining catches on the tabs. On the hardtop, apply trim cement to the entire roof side rails and cement the headlining in place.

11. Apply trim cement to the roof side rail at the quarter window opening. Pull the headlining to remove wrinkles, and cement it in place.

12. On station wagons, apply trim cement to the roof side rail at the edge of the stationary quarter window weatherstrip and cement the headlining in place. Trim the headlining approximately ½ inch below the weatherstrip edge and install the headlining under the weatherstrip.

13. Install the window garnish mouldings, tailgate window runs, coat hooks, seat back and seat cushion, sun visor assemblies, and rear view mirror.

14. Cut a hole in the headlining for the dome lamp. **Be sure the dome lamp lens will cover the hole.** Install the dome lamp lens.

Use warm water on a sponge to dampen a cloth headlining that sags or is slightly wrinkled or spray it with live steam. On vinyl headlinings, live steam must be applied to the back side of the headlining through the dome lamp opening. As it dries the headlining will shrink slightly, removing most wrinkles and sags.

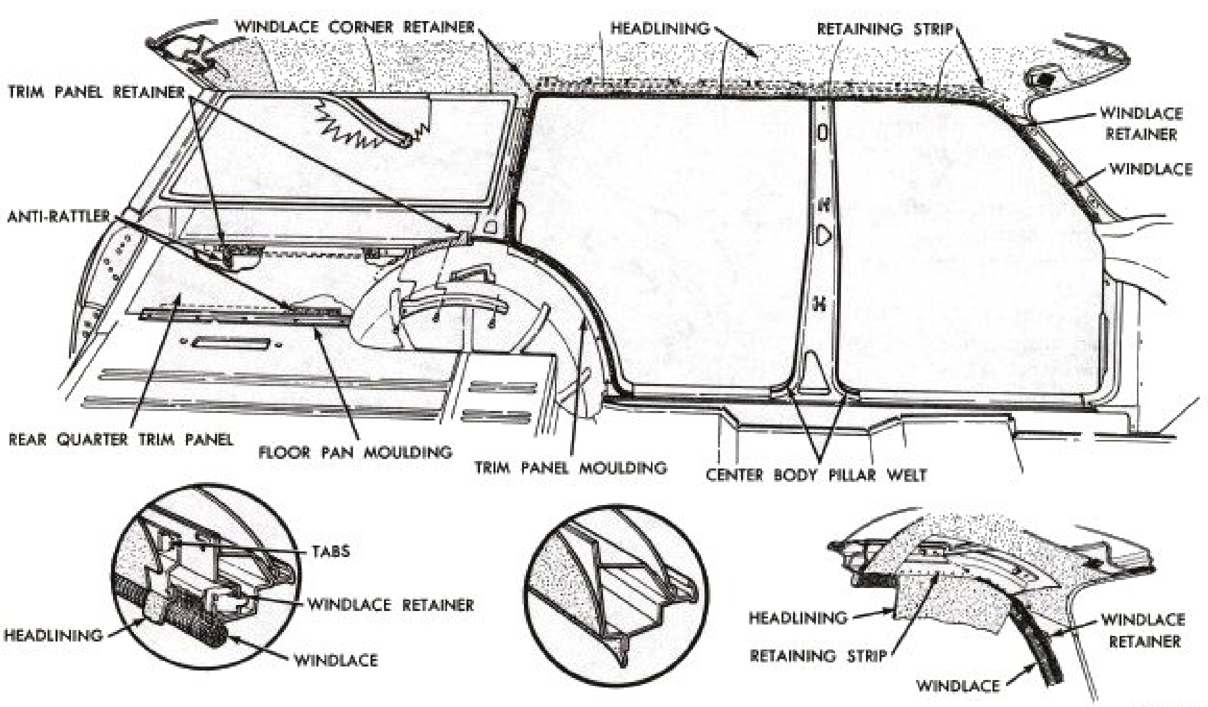

FIG. 5—Station Wagon Roof Trim—Typical

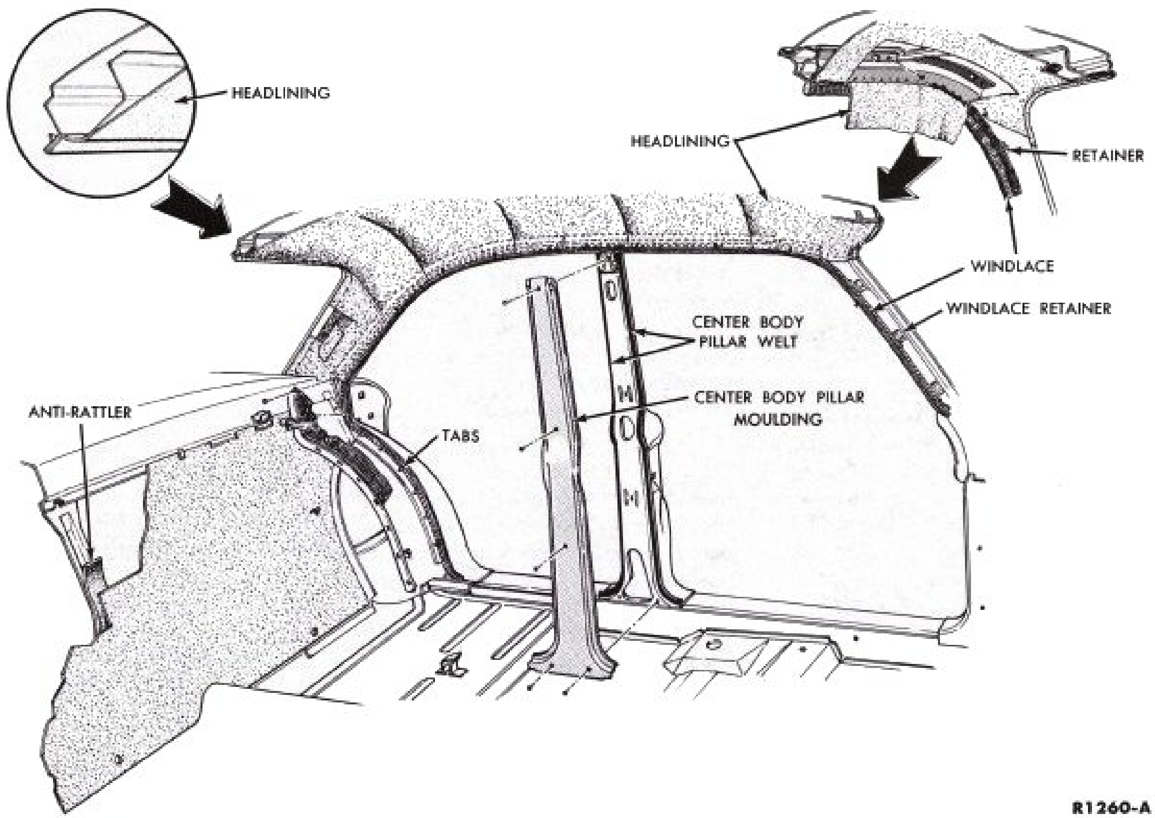

FIG. 6—Headlining—Typical

3 INSTRUMENT PANEL PAD

REMOVAL AND INSTALLATION

1. Remove the windshield interior garnish mouldings and sun visor assemblies.

2. Remove the lower instrument panel pad finish mouldings.

3. Remove the instrument panel pad.

4. Using solvent B6A-19563-D, clean the old cement from the instrument panel mounting surfaces.

5. Apply a two-inch band of adhesive (C2AZ-19C525-A) to the upper rear surface of the instrument panel as indicated by item "B" in Fig. 7 and View "AA". No adhesive is required on the pad assembly. The adhesive will reach a tacky consistency after approximately three minutes (Fig. 7).

6. Transfer the retaining clips from the old to the new cover. Position the cover assembly on the instrument panel and press firmly into position.

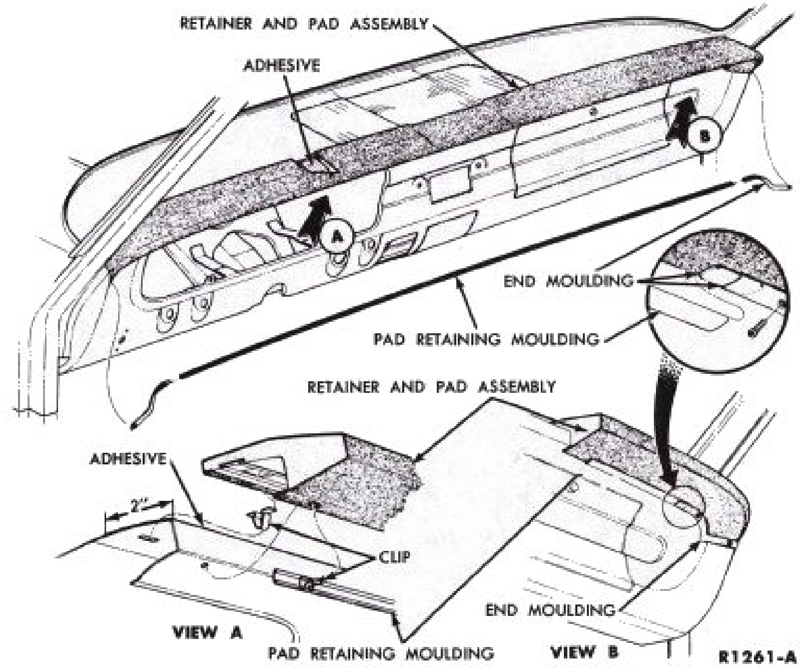

FIG. 7—Instrument Panel Cover Assembly

7. The cover assembly must be free of wrinkles and bulges. The edges of the pad assembly must be trimmed flush with the finish mouldings, after the finish mouldings have been installed.

8. Install the lower instrument instrument panel pad finish mouldings.

9. Install the windshield interior garnish mouldings and sun visor assemblies.

4 CONSOLE

REMOVAL AND INSTALLATION

The console assembly is shown in Fig. 8. The glove compartment liner must be removed for access to the hinge and lock. The console assembly body is replaceable and requires the glove compartment liner to be removed for access to the retaining screws.

5 ROOF OUTSIDE COVER

REMOVAL

1. Remove the windshield interior garnish mouldings and sun visor assemblies.

2. Remove the windshield exterior mouldings, retainers, and windshield wipers.

3. Remove the windshield and weatherstrip.

4. Remove the rear seat cushion seat back, and package tray panel.

5. Loosen the headlining sufficiently to permit access to the roof side lower ornaments.

6. Remove the roof side lower ornaments and the back belt moulding (Fig. 9).

7. Remove the drip rail mouldings.

8. Remove the sealer from the drip rails.

9. Using a 0.128-0.132 inch diameter drill, remove the rivets from the drip rail retainers and discard the retainers.

10. Remove and discard all roof cover assembly retaining drive nails and screws.

11. Remove and discard the cover assembly.

12. Remove all old sealer and/or cement from the roof panel and drip rail areas with cleaning solvent. **It is extremely important that the entire roof and drip rails are thoroughly cleaned.**

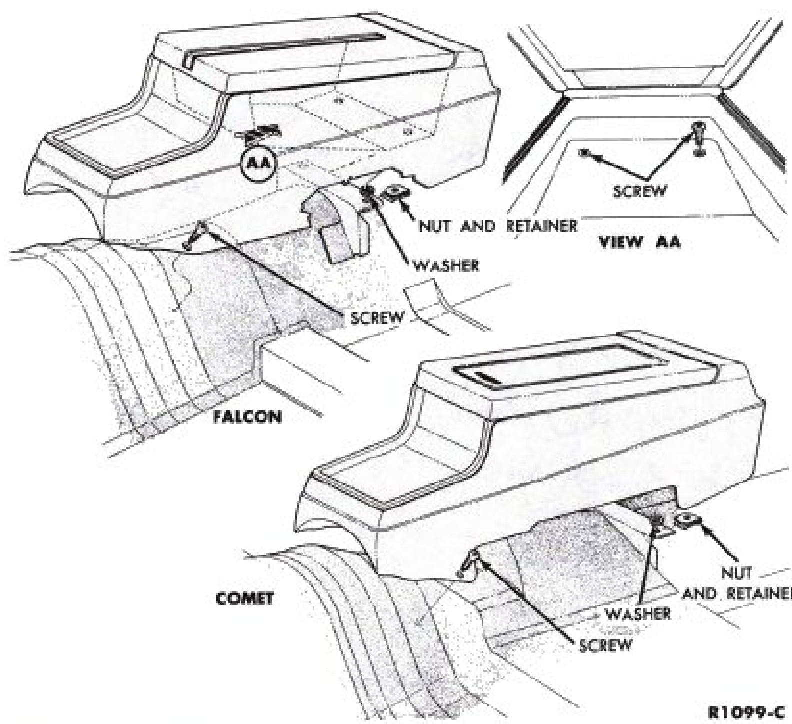

FIG. 8—Console Assembly

COVER ASSEMBLY INSTALLATION

It is recommended that the ⅛ inch oval head blind rivet (Part No. 378527-S) (Pop rivet) be substituted for the screw and the drive nail (Fig. 9).

Wherever possible, use the existing drive nail or screw holes. Therefore, each location should be identified on the pinch weld flange with a wax crayon.

Seal all unused holes with either C1AZ-19627 Pressure Sensitized Tape or AB-19560-A Sealer.

1. Carefully position the outside cover on the roof panel. ("Fore" and "Aft" center punch marks have been provided in the cover for centering purposes.)

2. With the cover properly positioned and temporarily secured, apply an even coating of C2AZ-19C-525 adhesive to the roof panel and a like amount to the corresponding area of the roof outside cover assembly. For best results, secure limited sections at a time. **Make certain the adhesive is not lumpy as it will be objectionable from an appearance standpoint.**

3. Using a 0.128-0.132 inch diameter drill, pierce the vinyl material at the existing drive nail or screw hole locations. Install Pop rivets in each of the holes.

4. Position both drip rail retainers

and, using the same drill referred to above, pierce the vinyl at each of the holes. Install the Pop rivets from the underside of the drip rail except at the extreme rear hole in which case the rivet should be inserted from the retainer side.

5. Trim the excess cover material from around the entire perimeter.

6. Apply sealer C3AZ-19562-A (for white tops) or sealer C3AZ-19562-B (for black tops) over the entire surface of the drip rail retainers. With the drip rail properly sealed, a minimum depth of ⅛ inch should be retained for adequate water drainage. **Place masking tape on the cover assembly for the entire length of the drip rail before applying sealer. After sealer has been applied, remove the tape.**

7. Install the drip rail mouldings.

8. Install the back belt moulding and the roof side lower ornaments.

9. Reposition and secure the headlining.

10. Install the back window in the usual manner.

11. Install the package tray panel, rear seat back and seat cushion.

12. Install the windshield in the usual manner.

13. Install the windshield interior garnish mouldings and sun visor assemblies.

14. Install the windshield exterior mouldings, retainers, and windshield wiper blade assemblies.

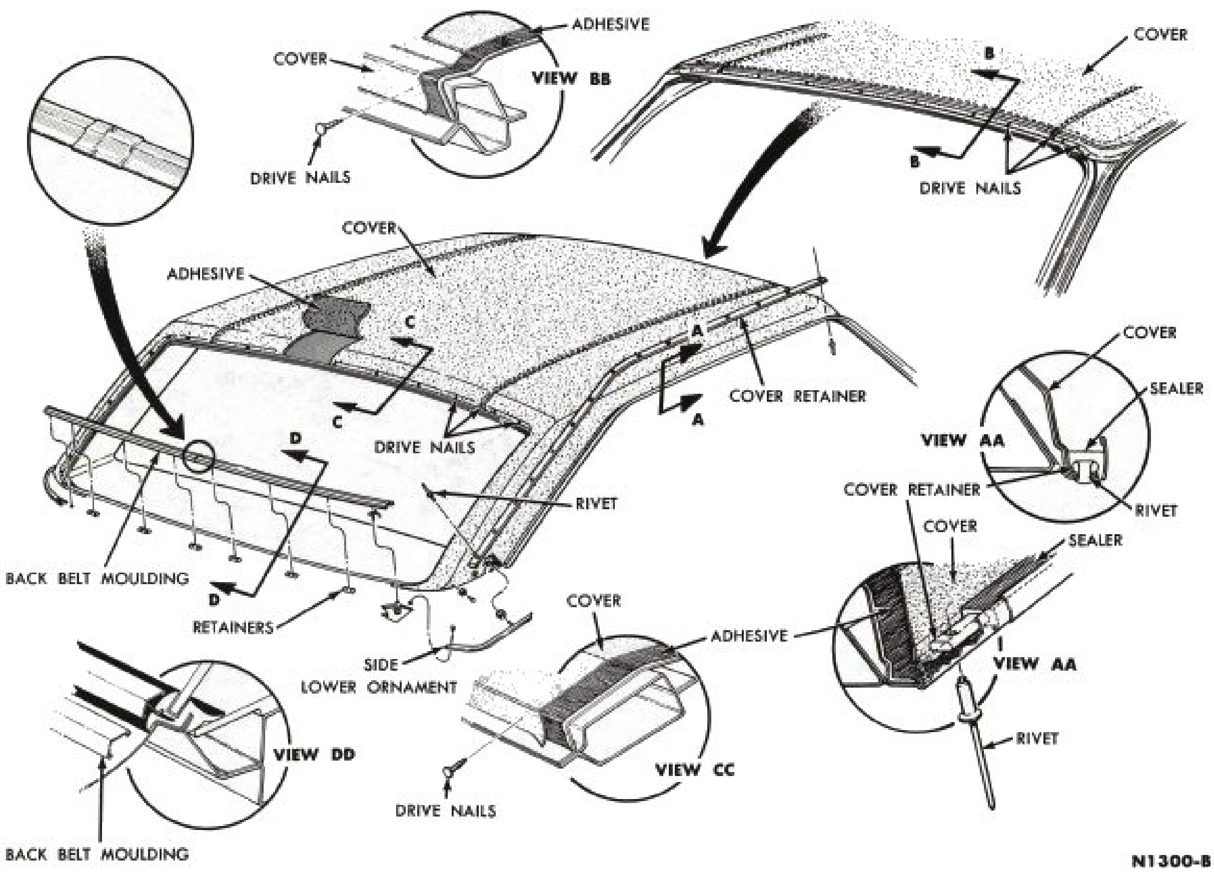

FIG. 9—Roof Outside Cover

PART 18-2 SEATS

1 STANDARD FRONT SEAT

SEAT CUSHION AND/OR BACK

REMOVAL AND INSTALLATION

Work, other than that of minor nature, is more easily performed when the front seat assembly is removed from the car.

1. Disconnect and remove the front seat retracting springs from the seat track (Fig. 1).
2. Remove the nuts retaining the seat tracks to the floor pan and lift the seat assembly from the car.
3. Disconnect and remove the tie rod from the eye bolt on the frame. Remove the seat tracks from the frame.
4. Transfer the seat adjusting lever knob to the new left hand track assembly.
5. On a car with a solid seat back, remove the bolts and washers attaching the seat back. Remove the hairpin clips from the pivot pins.
6. On a car with a split front seat back, remove the hairpin clip from the center seat back studs.
7. Remove the seat back.
8. Position the seat back assembly on the seat. On cars with the split back seat, install the hairpin clip at the seat center bracket.
9. Install hairpin clips on the seat back pivot pin. On a car with a solid seat back, install the bolts and washers attaching the seat back to the seat.
10. Position the new seat tracks on the frame and install the retaining bolts and tie rod.
11. Position the seat assembly in the car and install the retaining bolts and nuts. Install the retracting springs.

TIE ROD ADJUSTMENT

Tie rod maladjustment will affect only the right side of the seat. In case the latch retaining the track fails to release, turn the tie rod turnbuckle or eye bolt enough turns to shorten the tie rod travel sufficiently to release the track latch. If the latch fails to secure the seat travel, turn the tie rod turnbuckle or eye bolt to lengthen the tie rod enough to allow the latch to snap in the locking position.

STANDARD SEAT CUSHION AND/OR PAD

REMOVAL AND INSTALLATION

Repairs to seat cushions are performed out of the car and are usually limited to the replacement of torn or burned seat covers. In a few instances, the pads may be damaged and require replacement.

Fig. 2 shows a front seat cushion build-up. Seat cushions for all other models are built up in basically the same manner. Therefore, when installing new seat cushion covers or pads, refer to Fig. 2 for the location of listing wires, hog rings, anti-squeak pads, and seat pad stack-up.

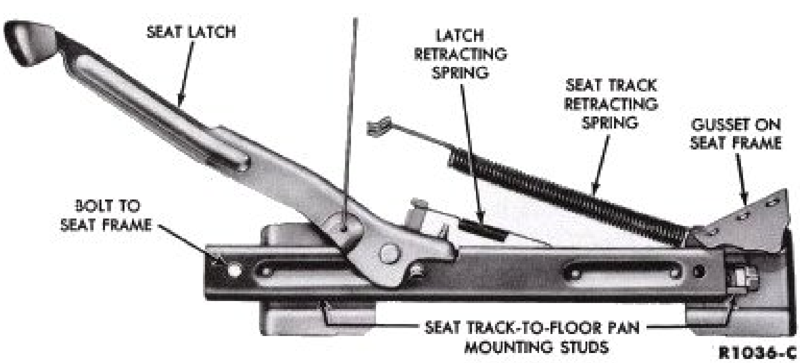

FIG. 1–Typical Front Seat Mechanism

When installing a new seat cushion cover, follow these basic instructions:

1 With the seat cushion assembly right side up, make sure the pads are stacked properly and centered; then place the cover over the pads to hold them in position.
2. Carefully turn over the seat assembly so that the pads do not shift out of position.
3. After centering the cover and straightening the seams along the front edge of the cushion, fasten the cover to the front of the seat frame with hog rings. Make sure the hog rings encircle the listing wire. Install one hog ring in each hole provided in the seat cushion frame.
4. At the rear of the seat assembly, pull the cover taut over the pads, and install two hog rings at the center elements of the spring assembly and one hog ring at every other element out to the edge.
5. Fasten the side of the cover to the seat frame side with hog rings through the holes provided (Fig. 2).

STANDARD SEAT BACK COVER AND/OR PAD

INSTALLATION

Repairs to seat backs are performed out of the car and are usually limited to replacement of torn or burned seat covers. In a few instances, the pads may be damaged and require replacement.

Fig. 3 shows a front seat back build-up. Seat backs for all other models are built up in basically the same manner. Therefore, when installing new seat back covers or pads, refer to Fig. 3 for the location of listing wires, hog rings, anti-squeak pads, and seat pad stack-up.

When installing a new seat back cover, follow these basic instructions:

1. With the seat back assembly right side up, make sure the pads are stacked properly and centered; then place the cover over the pads to hold them in position.
2. Carefully turn over the seat back assembly so that the pads do not shift out of position.

3. After centering the cover and straightening the seams along the front edge of the back, fasten the cover to the front of the seat frame with hog rings encircle the listing with hog rings. Make sure the hog rings encircle the listing wire. Install one hog ring in each hole provided in the seat back frame.

4. At the rear of the seat back assembly, pull the cover taut over the pads, and install two hog rings at the center element of the spring assembly and one hog ring at every other element out to the edge.

5. Fasten the side of the cover to the seat frame side with hog rings through the holes provided (Fig. 2).

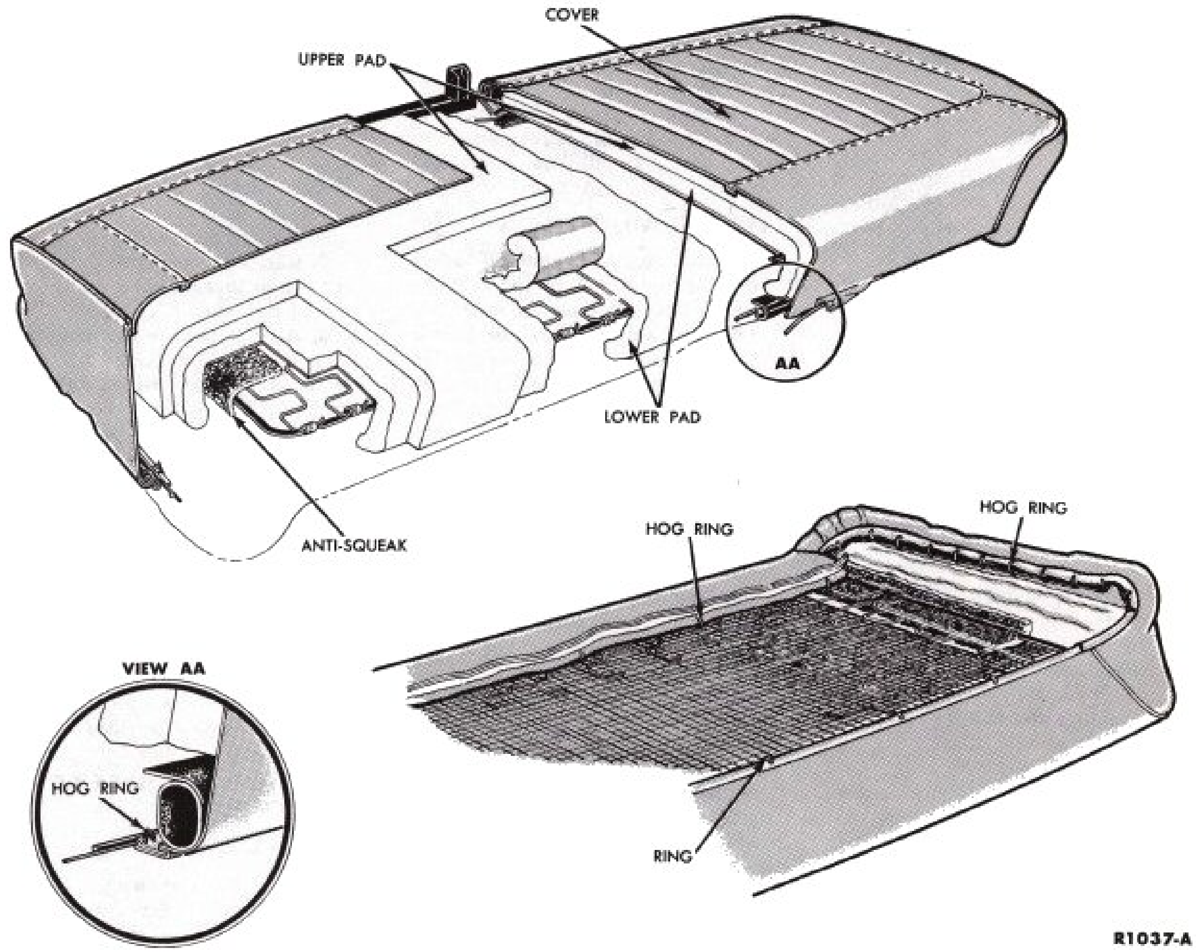

FIG. 2—Full Front Seat Cushion Build-Up—Typical

2 BUCKET SEATS

The seat is mounted in the conventional manner on two seat tracks. The seat release is located at the lower front center of the seat, and is operated by pulling the lever up to release the seat tracks.

SEAT AND SEAT TRACK

REMOVAL AND INSTALLATION

The seat track assembly is easily replaced if the seat assembly is removed from the car.

1. From underneath the car, remove the seat track retaining stud nuts and washers. Remove the seat assembly from the car and place it on a clean work area.

2. Remove the screws which retain the seat track assembly to the seat cushion and remove the seat track assembly.

3. Disconnect the seat track brace and latch release rod from the track being replaced, and connect these parts to the new seat track.

4. Loosely install the track-to-floor retaining studs in the seat track.

5. Place the seat track assembly on the seat cushion, and install the retaining screws.

6. Place the seat assembly in the car and install the washers and nuts on the retaining studs.

FRONT SEAT CUSHION COVER

REMOVAL AND INSTALLATION

Repairs to seat cushions or seat backs are performed out of the car and are usually limited to replacement of torn or burned seat covers. In a few instances, the pads may be damaged and require replacement.

When installing a new seat cover or pad, refer to Fig. 4 for the location of listing wires, hog rings, anti-squeak pads, and seat pad stack-up.

1. Remove the seat track retaining stud nuts and washers. Remove the seat assembly from the car and place it on a clean work area.

2. Remove the seat assembly, and then remove the cushion side shields and seat track assembly. From each side of the seat, remove the seat back retaining pin and retainer, and then remove the seat back.

3. Remove the seat back scuff plates and remove the hog rings retaining the seat cushion cover to the spring assembly (Fig. 4). Separate the bottom facing from the cushion cover top rear panel, and allow the facing to remain cemented to the foam rubber pad. Remove the cushion cover.

4. Inspect the pad and spring assemblies, and repair or replace as necessary.

5. Transfer the listing wires to the new cover.

6. Place the new cover assembly over the pad and seat spring assembly and secure it to the front bolster wire with five hog rings. Apply M-2G17-A cement to the bottom of the cushion cover top rear panel and to the old facing which was left cemented to the foam rubber pad.

7. Secure each side bolster wire to the seat spring assembly with six hog rings.

8. The front and side edges of the cover assembly can now be secured to the bottom of the spring assembly with hog rings as shown in Fig. 4.

9. Secure the rear edge of the cover assembly to the bottom of the spring assembly with six hog rings.

10. Install the two scuff plates on the cushion.

11. Install the cushion side shields, seat back, and seat tracks. Install the seat assembly.

FRONT SEAT BACK COVER

REMOVAL AND INSTALLATION

1. From each side of the seat, remove the seat back pivot arm retaining pin and retainer, and then remove the seat back. Remove the two seat back stops and seat back pivot arm covers, and remove the panel cover from the seat back (Fig. 4). Remove the hog rings from the seat back assembly, bend the tabs up on the seat back, and remove the seat back cover. Inspect the pad and spring assemblies, and repair or replace as necessary.

2. Transfer the listing wires to the new cover.

3. Place the new cover over the pad and spring assembly, and with 17 equally spaced hog rings, secure the cover to the bolster wire (Fig. 4).

4. Pierce the cover over the side and bottom retaining tabs, and bend the side retaining tabs toward the center of the seat.

5. Pull the lower rear edge of the cover over the bottom of the spring assembly, and secure each side with

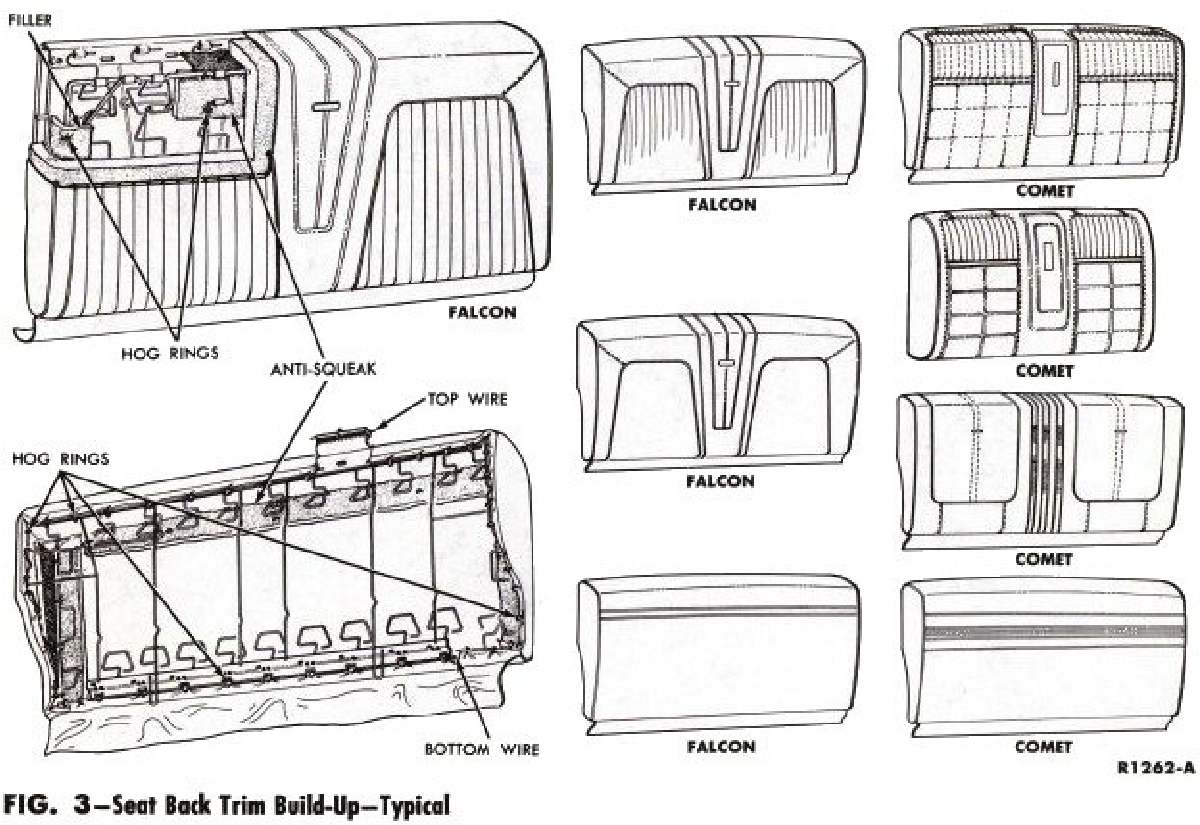

FIG. 3—Seat Back Trim Build-Up—Typical

three hog rings (Fig. 4).

6. Pull the lower front edge of the cover over the bottom of the spring assembly, and secure to the lower rear edge of the cover with one hog ring on each side (Fig. 4). Secure the lower listing of the cover assembly to the spring assembly with five hog rings, pierce the cover over the bottom retaining tab, and bend each tab toward the top of the seat.

7. Secure the top rear edge of the cover assembly to the spring assembly with five hog rings.

8. Install the seat back panel with the retaining clips, the seat back pivot arm covers, and the two seat stops to the seat back assembly.

9. Connect the seat back to the seat cushion and install the pivot arm retainers and retaining pins.

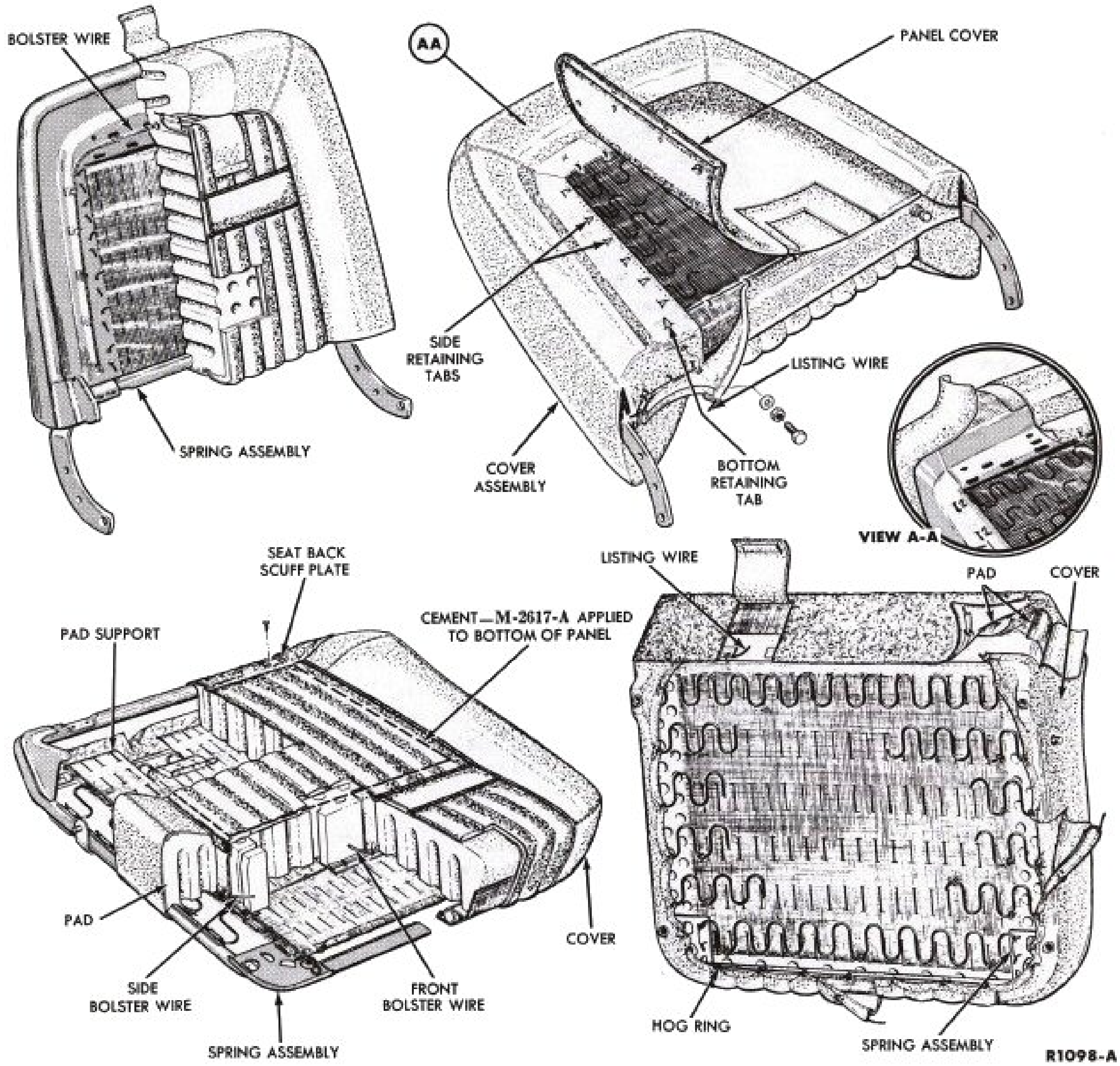

FIG. 4—Bucket Seat Back and Cushion

PART 18-3 CONVERTIBLE TOP

Section	Page

1 CARE OF TOP FABRIC

Proper care of the top material will reduce the possibility of water stains, mildew, or shrinkage. Do not stack the top if it is damp. Always use the convertible top vinyl boot to keep the top material clean, dry, and positioned when the top is stacked.

The rear window slide fastener should be lubricated at least once a year with stainless stick lubricant.

Use the top compartment behind the rear seat back only for storage of the top. The storage of other items not only interferes with the proper operation of the top, but may also damage or stain the top material.

The vinyl top may be washed each time the car is washed. Clean the material with FoMoCo Interior Trim Cleaner and a scrub brush. Be sure to rinse the top thoroughly with clean water during and after washing.

Do not use a cleaning material that is not recommended for vinyl material because damage to the top may result.

The vinyl coating becomes tacky at approximately 180°F. Therefore, when making paint repairs, be sure to protect the top material from heat.

2 DIAGNOSIS AND TESTING

If the top cannot be lowered or raised satisfactorily, or if it fails to operate at all, and the trouble is not readily apparent, make the following mechanical, electrical, and hydraulic tests to find the cause of the trouble. **Always check the battery before making any of the following checks.**

Table 1 shows symptoms and possible causes of trouble.

MECHANICAL CHECKS

1. If the action of the top is slow, raise and lower it and look for bent or misaligned linkage.

2. If binding is noted when clamping the top at the header, check the alignment of the door and the quarter windows with the side rail weatherstrips. Also check the top sag adjustment and toggle clamp adjustment.

ELECTRICAL TESTS

BATTERY CHARGE

The battery charge should be determined before making any electrical checks because a partially discharged battery will cause slow motor and pump operation.

CURRENT DRAW

To check the current draw in the top operating circuit, disconnect the black wire at the circuit breaker (located on the starter relay), and connect an ammeter in series in the circuit (Fig. 1). Operate the top control switch and not the ammeter readings. The current draw should be 35 amperes maximum operating, and 40-50 amperes stalled, with a voltage reading of 9-10. Current in excess

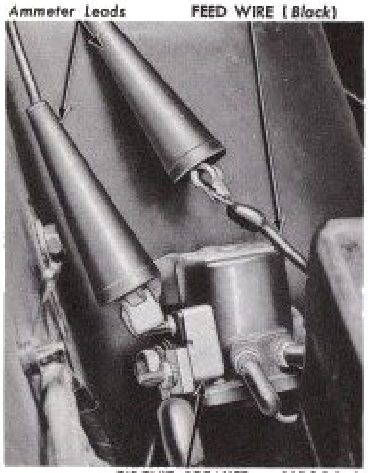

FIG. 1—Testing Motor Current Draw

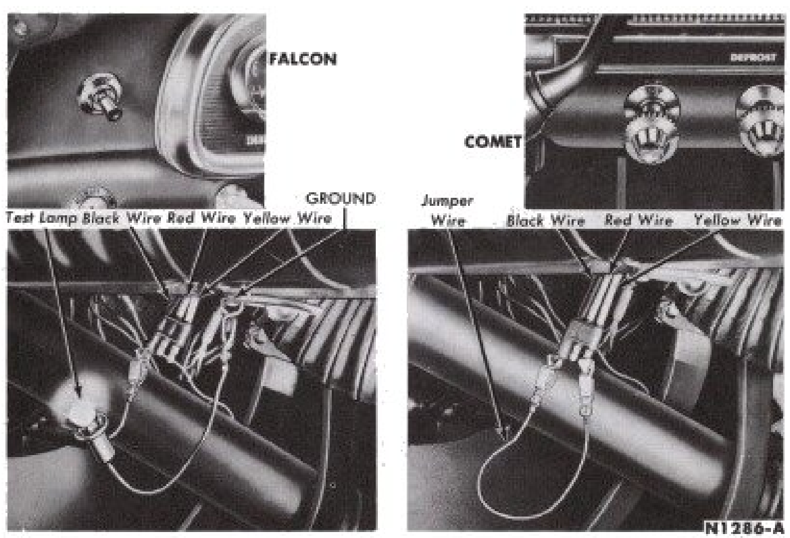

FIG. 2—Testing Switch Wiring

TABLE 1—Trouble Symptoms and Possible Causes

Possible Causes of Trouble Symptoms	Trouble Symptoms: Top Does Not Retract	Top Action Sluggish	Top Sides Operate Unevenly	Top Does Not Stack	Side Rail(s) Do Not Fit	Top Does Not Rise From Stack	Top Does Not Latch	Top Leaks
Top Control Switch	X					X		
Inadequate Battery Charge	X	X				X		
Motor	X					X		
Circuit Breaker	X					X		
Faulty Wiring	X	X				X		
Hydraulic Cylinder(s)	X	X	X			X		
Air in Hydraulic System	X	X				X		
Insufficient Hydraulic Fluid	X	X				X		
Bent Linkage	X	X	X			X	X	X
Top Lowered when Wet Causing Fabric to Shrink							X	
Pivot Bracket Adjustment				X			X	
Toggle Clamp Adjustment*							X	X
Door Window Adjustment*					X			X
Quarter Window Adjustment*					X			X
Weatherstripping								X
Balance Link Bracket Adjustment				X	X			

*Top should not be raised with windows up.

of 75 amperes indicates a frozen pump or cylinder or a mechanical obstruction. Low amperage with the motor running and no top movement indicates a defective pump or low fluid level in the reservoir.

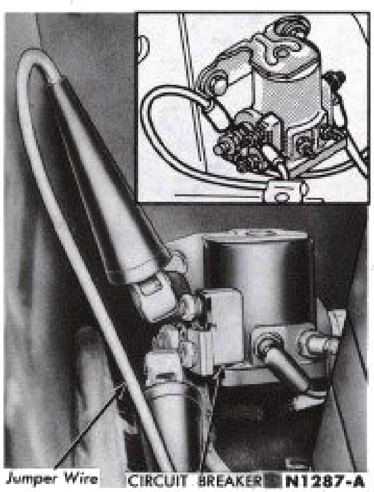

FIG. 3—Testing Circuit Breaker

TOP CONTROL SWITCH

1. Disconnect the wiring harness at the switch multiple connector located behind the instrument panel.
2. Connect one terminal of a test lamp to the black (feed) wire of the top control switch, and ground the other lead (Fig. 2). If the test lamp does not light, there is an open or short circuit between the battery and the switch.
3. If there is voltage to the switch, connect a jumper wire between the black (feed) wire and the red wire, and then between the black wire and the yellow wire (Fig. 2). If the top motor operates, the switch is faulty and must be replaced.

CIRCUIT BREAKER

If there is no voltage at the top control switch, connect a jumper wire across the terminals of the circuit breaker (located on the starter relay) and operate the switch (Fig. 3). If the top motor operates, the circuit breaker is faulty and must be replaced. If there is no voltage at the circuit breaker, check the black wire from the circuit breaker to the starter relay.

SWITCH-TO-MOTOR WIRES

Disconnect the yellow and the red switch-to-motor leads at the junction block near the motor. Connect a 12-volt test lamp between the yellow wire and a ground (Fig. 4) and

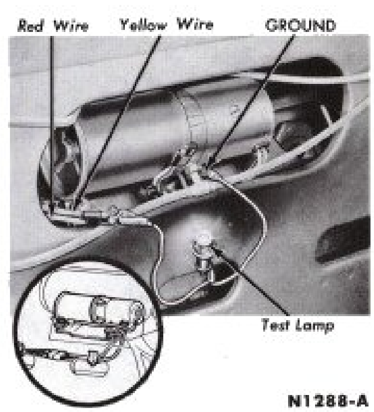

FIG. 4—Testing Switch to Motor Wiring

check by operating the top control switch to raise the top. Connect the test lamp between the red wire and a ground, and check by operating the switch to lower the top. If the test lamp does not light in either case, the wire from the junction block to the switch is open or shorted.

MOTOR

Check the operation of the motor by connecting first one motor lead, and then the other, directly to the battery positive terminal (Fig. 5). If the motor operates in either case, but will not operate when hooked into the wiring harness, check the wiring harness again for short or open circuits. If the motor will not work when hooked directly to the battery, check the black (ground) wire from the motor. If the motor still does not work, it must be replaced.

HYDRAULIC CHECK TESTS

Faulty hydraulic system operation can be caused by lack of fluid, leaks, air in the system, obstructions or kinks in the hoses, or faulty operation of cylinder or the pump.

FLUID LEVEL

1. Remove the rear seat and raise the top.
2. Place absorbent cloths below the filler plug.
3. Remove the filler plug, and check the fluid level. It should be level with the bottom edge of the hole.
4. If the level is low, check the system for leaks, adding automatic transmission fluid "Type A, Suffix A" as necessary.

LIFT CYLINDER

Remove the rear seat and the quarter trim panels, operate the top control switch, and observe the operation of the lift cylinders for the following:

If the movement of the piston rods is sluggish or uneven, check the hoses from the pump to the cylinders for kinks.

If one piston rod moves more slowly than the other, the cylinder with the slower rod is defective and should be replaced.

If both rods move slowly, or do not move at all, disassemble and repair the pump.

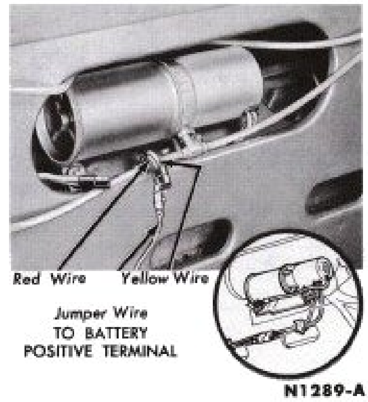

FIG. 5—Testing Motor

3 ADJUSTMENTS AND LIGHT REPAIRS

If the top is misaligned, corrections should not be made until after a check has been made for bent linkage.

Before aligning the top, visually determine if the trouble results from top misalignment and/or window misalignment. It may be necessary to align both the top and the windows because of the relationship between the two. Adjustments of the door and quarter windows must be checked and any necessary changes made before making top adjustments. These windows must be fully closed to insure proper adjustment. Door window and quarter window adjustments are outlined in Part 17-3.

SIDE RAIL WEATHERSTRIPS ADJUSTMENTS

The side rail weatherstrips can be adjusted laterally and also fore and aft. Adjust the weatherstrips laterally so that the sealing lips make full contact with the door and quarter window frames. Adjust the weatherstrips fore or aft to butt the ends of the weatherstrips together for a watertight seal (Fig. 6).

STRIKER PLATE ADJUSTMENT

The striker plates must be aligned with the dowel pins prior to making other top adjustments. The dowel pins are not adjustable. A slight lateral adjustment of the striker plate is provided by loosening the striker plate retaining screws (Fig. 7).

TOGGLE CLAMP ADJUSTMENT

The toggle clamps that hold the header bow against the header can be adjusted to provide a good seal.

1. To determine which side is not sealing, check the weatherstrip between the header bow and the header. Refer to Fig. 6 for side rail weatherstrip installation. Both toggle clamps need not be adjusted unless necessary.

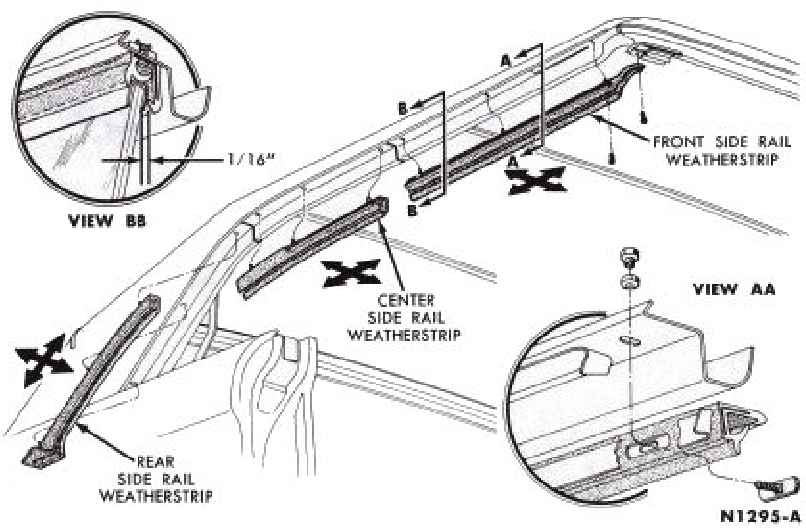

FIG. 6—Convertible Top Weatherstrip Adjustments

2. Release the toggle clamps, and thread the toggle hook in or out until adequate sealing pressure is applied at the header weatherstrip. Excessive tightening of the toggle hooks will distort the No. 1 how and cause poor weatherstrip sealing.

BALANCE LINK ADJUSTMENT

The balance link adjusting bracket is mounted on the main pivot bracket support (Fig. 8). Two adjustments are provided at the bracket. Sliding the bracket in the elongated mounting holes permits proper stacking of the top in the well. Turning the Allen head adjusting screw adjusts the side rail to glass clearance.

SIDE RAIL SAG

If the side rail sags above the door glass, adjust as follows:

1. Use the top of the door glass and quarter glass as reference points to determine the proper level of the side rail.
2. Have the top locked in the fully raised position.
3. With an Allen wrench, turn the adjusting screw in the balance link adjusting bracket down to raise the side rail. The adjusting bracket retaining screws should be loosened during this adjustment.
4. If the side rail is too high, or crowned, above the windows, turn the adjusting screw up to lower the side rail.

TOP STACK

When the top is stacked, it may be too high in the well. If the top stacks too high, it will be difficult to fasten down the boot. To obtain proper stacking, proceed as follows:

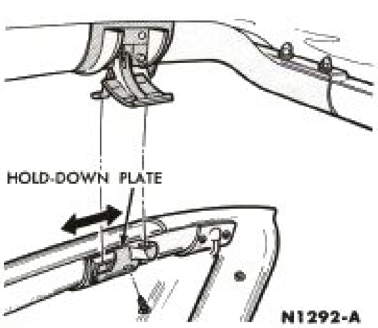

FIG. 7—Striker Plate Adjustment

1. If the top stacks too high in the well, loosen the main pivot bracket mounting screws, and let the bracket seek its own position, then tighten the main pivot bracket retaining screw.

MAIN PIVOT BRACKET ADJUSTMENTS

The main pivot bracket is mounted on the main pivot bracket support. The support is mounted to the inner quarter panel and the wheelhouse extension. The main pivot bracket mounting support provides for shifting of the entire top assembly, fore and aft, vertically and laterally.

FORE AND AFT ADJUSTMENT

This adjustment moves the top assembly straight forward or rearward to obtain a good fit between the rear side rail weatherstrip and the rear edge of the quarter glass. The top assembly can also be moved across the windshield header by this adjustment.

1. Loosen the balance link retaining screws and disconnect the top assembly lift cylinders.
2. Loosen the screws which retain the main pivot bracket support to the inner quarter panel and to the wheelhouse extension (Fig. 9).
3. Shift the entire pivot bracket support fore or aft as required to bring the rear side rail in proper relationship to the quarter glass, and tighten the main pivot bracket retaining bolts.
4. Tighten the balance link retaining screws and connect the top assembly lift cylinder.

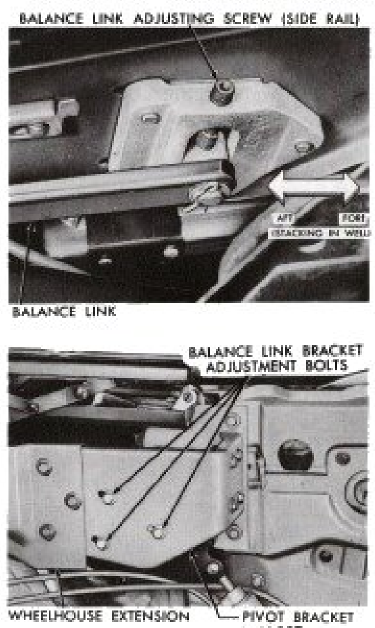

FIG. 8—Balance Link and Bracket Adjustment N1293-A

VERTICAL ADJUSTMENT

This adjustment moves the top assembly up or down to obtain a good fit between the windshield header and the top assembly and the top assembly and the window glass line, the rear and center side rail weatherstrip and the top of the quarter and door glass.

1. Loosen the screws which retain the main pivot bracket to its support (Fig. 9).
2. Shift the main pivot bracket up or down as necessary to obtain the proper clearance along the side rails and the quarter and door glass.

LATERAL ADJUSTMENT

This adjustment shifts the top assembly sideways to obtain a good seal between the side of the rear side rail and the quarter outside rear side belt moulding.

1. Loosen the screws which retain the main pivot bracket to its support.
2. Shift the main pivot bracket toward either side as necessary to obtain the proper clearance (0.38 inch) between the rear side rail and the quarter outside rear side belt mouldings, and tighten the retaining screws.
3. Adjust the side rail weatherstrips as necessary to obtain a satisfactory seal along the glass line.

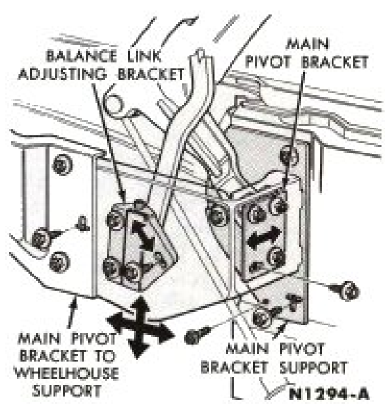

FIG. 9—Main Pivot Bracket Adjustments

4 REMOVAL AND INSTALLATION

MOTOR AND PUMP

A pump repair kit and a reservoir repair kit are available for service.

REMOVAL

1. Operate the top to the fully raised position.

2. Remove the rear seat cushion and seat back.

3. Disconnect the motor leads and the ground wire.

4. Remove the attaching screws, and remove the motor and pump assembly from the floor pan. Do not lose the rubber grommets.

5. Vent the reservoir by removing the filler plug, and then install the filler plug. **The reservoir must be vented in order to equalize the pressure. This lessens the possibility of fluid spraying on the trim and paint when the hoses are disconnected.**

6. Place absorbent cloths beneath the hose connections, disconnect the hoses, and then plug the open fittings and lines.

DISASSEMBLY

1. Remove the filler plug, and drain the fluid from the reservoir into a clean container.

2. Scribe lines on the reservoir, pump body, and reservoir cover so these parts can be positioned properly upon assembly (Fig. 10).

3. Remove the center bolt from the reservoir cover (Fig. 11).

4. Remove the cover and reservoir, and the seal at each end of the reservoir.

5. Remove the mounting bolts that hold the valve body on the pump body.

6. Place a cloth under the assembly, and carefully remove the valve body so that the check balls are not lost.

7. Remove both rotors and the drive ball.

ASSEMBLY

Use all the parts contained in the pump repair kit when assembling the pump or reservoir.

1. Install the drive ball and inner rotor on the armature shaft.

2. Install the outer rotor over the inner rotor.

3. Place the check balls in the pump body channels.

4. Install the valve body on the pump body.

5. Install the valve body mounting bolts.

6. Install a seal in each end of the reservoir.

7. Install a new seal on the center bolt, and install the reservoir and cover on the valve body, using the lines previously scribed as guides (Fig. 10).

8. Place the assembly in a horizontal position, fill the reservoir with automatic transmission fluid "Type A, Suffix A" to the level of the bottom of the filler plug hole. Install the filler plug and a new seal.

INSTALLATION

1. Remove the plugs from the lines and fittings, and connect the lines to the pump. Use cloths to absorb any fluid that leaks out of the lines or the pump.

2. Install the assembly on the floor pan, making sure the rubber grommets are in proper position under the mounting brackets.

3. Connect the motor lead wires at the junction block, and connect the ground wire.

4. Operate the top assembly two or three times to bleed any air from the system, and check the fluid level in the reservoir. **The top must be up when the level is checked.**

5. Install the rear seat back and seat cushion.

LIFT CYLINDER

REMOVAL AND INSTALLATION

1. Operate the top to the fully raised position.

2. Remove the quarter trim panels and the rear seat cushion and back.

3. Disconnect and plug the hydraulic lines at the upper and lower ends of the cylinder. Use absorbent cloths to catch any fluid that leaks out.

4. After removing the hair pin clip and clevis pin at each end of the cylinder (Fig. 12), remove the cylinder.

5. Position the cylinder in the floor bracket with the hose connections facing down.

6. Install the clevis pin and hair pin clip at each end of the cylinder.

7. Connect the hydraulic lines to the cylinder.

8. Operate the top assembly two or three times to bleed any air from the system.

9. With the top in the raised position, check the reservoir fluid level.

10. Install the quarter trim panels and the rear seat back and cushion.

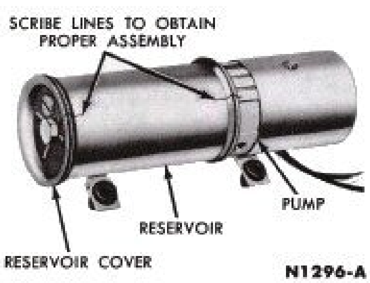

FIG. 10—Reservoir Marked Before Disassembly

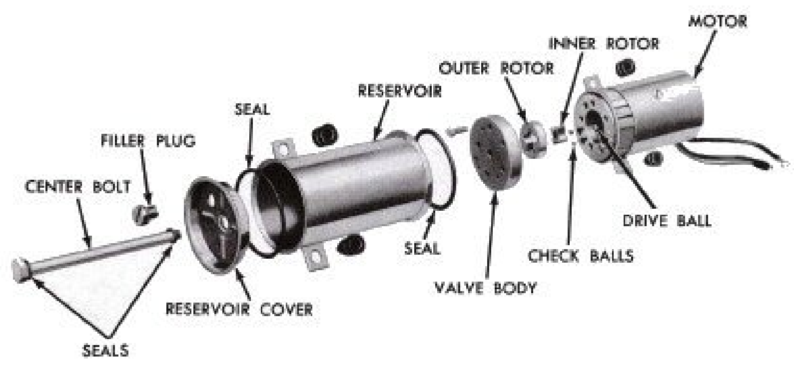

FIG. 11—Motor and Pump Disassembled

TOP REAR SIDE RAIL

REMOVAL AND INSTALLATION

1. Unfasten the clamps that hold the top to the windshield header.

2. Remove the rear seat cushion, seat back, and quarter trim panel.

3. Remove the bolts and nuts retaining the rear side rail weatherstrip (Fig. 6) and remove the weatherstrip.

4. Pull the top fabric from the rear side rail.

5. Lift the top and temporarily support it in a vertical position. Remove the cotter pin and washers retaining the pivot pin at the control link, rear side rail, and No. 3 bow bracket. Lift the top to the closed position, but do not fasten the windshield header clamps.

6. With a block of wood, support the center side rail.

7. Remove the roll pin and pivot pin retaining the center side rail to the rear side rail.

8. Remove the cotter pin, washers, and pivot pin retaining the rear bow and rear side rail.

9. Remove the pivot pin retaining the top control link, rear side rail and No. 3 bow.

10. Remove the roll pin and pivot pin retaining the power link to the rear side rail.

11. Pry the rear side rail from the center side rail.

12. Remove the cotter pin, washer, and pivot pin retaining the rear side rail to the main pivot bracket support.

13. Remove the rear side rail.

14. Transfer the rear side rail bushings and deflector to the new rear side rail.

15. Connect the rear side rail to the main pivot bracket with the pivot pin, washer and cotter pin.

16. Connect the power link to the rear side rail with the pivot pin and roll pin.

17. Connect the center side rail to the rear side rail with the pivot pin and roll pin.

18. Connect the rear bow to the rear side rail with the pivot pin, washer, and cotter pin.

19. Lift the top, temporarily support it in a vertical position, and remove the center side rail temporary support. Connect the top control link and the No. 3 bow to the rear side rail with the pivot pin, washer, and cotter pin.

20. Close the top and fasten the windshield header clamps.

21. Cement the top fabric to the rear side rail and install the weatherstrip.

22. Install the quarter trim panel, rear seat back and seat cushion.

BACK CURTAIN WINDOW

REMOVAL AND INSTALLATION

1. Unfasten the clamps that hold the top to the windshield header.

2. Unsnap the well cover from the back curtain window rear and side belt tacking strips.

3. Remove the bolts and lock washers that retain the curtain tacking strip to the body panel.

4. Open the back curtain window slide fastener and remove the curtain assembly.

5. Pull the tacking strips from the curtain and remove the staples from the tacking strip (Fig. 13).

6. Remove the tacking strip lock screws from the tacking strips.

7. Properly position the curtain and staple securely to the tacking strip.

8. Staple the side tacking strips to the curtain.

9. Position the curtain assembly to the body panel, and loosely install the belt tacking strip retaining bolts and lock washers.

10. Close the curtain window slide fastener.

11. To adjust the curtain window tension and remove wrinkles, tighten or loosen the tacking strip retaining bolts as required. After adjusting the curtain, install and tighten the tacking strip lock screws until they bottom against the body panel.

12. Snap the top well cover retainers into the tacking strip.

UPPER HALF CURTAIN SLIDE FASTENER

REMOVAL AND INSTALLATION

1. Unfasten the top clamps at the windshield header, and then open the curtain window slide fastener.

2. Remove the rear bow binding

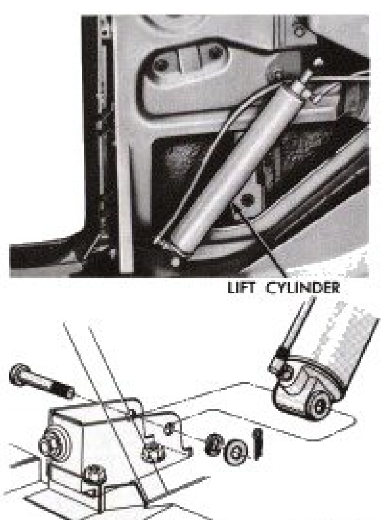

FIG. 12—Lift Cylinder Assembly

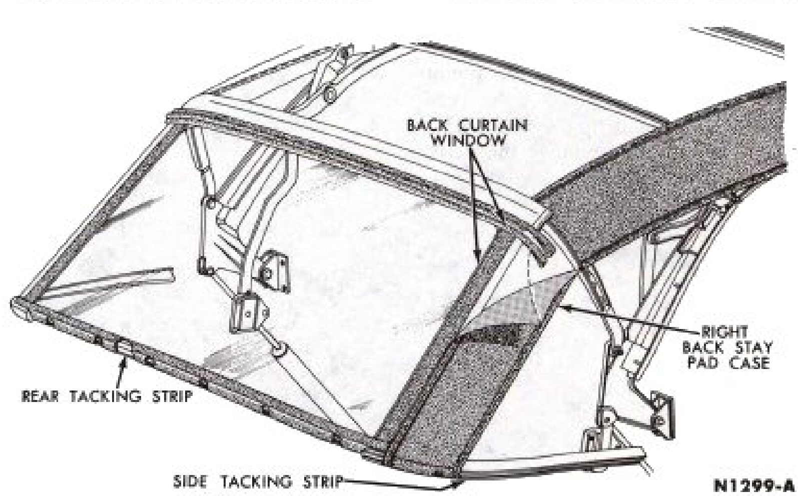

FIG. 13—Back Curtain Window

end cap, slide out the binding insert, and remove the staples and binding (Fig. 13).

3. Remove the staples retaining the top deck and quarter assembly to the rear bow.

4. Disengage the belt line tacking strips from the body.

5. Remove the staples retaining the top right and left back stay pad case assemblies to the rear bow (Fig. 13).

6. Remove the staples retaining the slide fastener to the rear bow tacking strip and remove the slide fastener.

7. Use the center dot in the curtain and center groove in the No. 4 bow to properly position the slide fastener.

8. Staple the top left and right back stay pad case assemblies to the rear bow tacking strip. Seal the unused holes in the top material.

9. Staple the top deck and quarter assembly to the rear bow tacking strip.

10. Staple the binding in position, and install the binding end caps.

11. Close the slide fastener, and then fasten the top clamps at the windshield header.

12. To adjust the curtain window tension and remove wrinkles, loosen the tacking strip lock screws. Adjust the tacking strip retaining bolts as required.

13. After adjusting the curtain, tighten the tacking strip lock screws until they bottom against the body panel. Snap the top well cover retainers into the tacking strip.

LOWER HALF CURTAIN SLIDE FASTENER

REMOVAL AND INSTALLATION

1. Unfasten the convertible top clamps at the windshield header.

2. Unsnap the convertible top well cover from the curtain rear and side belt tacking strips.

3. Remove the bolts and lock washers that retain the curtain tacking strip to the body panel.

4. Open the curtain window slide fastener, and remove the curtain assembly.

5. Cut the old slide fastener from the curtain and sew the new slide fastener in place.

6. Loosen the tacking strip lock screws.

7. Close the curtain window slide fastener, and tighten or loosen the tacking strip retaining bolts as required. After adjusting the curtain, tighten the tacking strip adjustment retaining screws until they bottom against the body panel.

8. Install the belt tacking strip retaining bolts and lock washers.

9. Snap the top well cover retainers into the tacking strip.

CONVERTIBLE TOP FABRIC

The convertible top consists of the deck and two side quarters, bonded into one piece of material. The bonded seams eliminate the possibility of leaks and also separation, due to thread deterioration. In most cases it will be advantageous to replace the back curtain when replacing the top fabric.

REMOVAL

1. Place a protective cover across the deck, cowl and hood to prevent scratching the finish when replacing the top.

2. Remove the rear seat cushion and seat back.

3. Raise the top to gain access to the underside of the front bow.

4. Remove the front weatherstrip retainer (Fig. 14) and the weatherstrip. Remove the windshield header seal.

5. Remove both front side rail weatherstrips.

6. Remove the two center side rail and the two rear side rail weatherstrips.

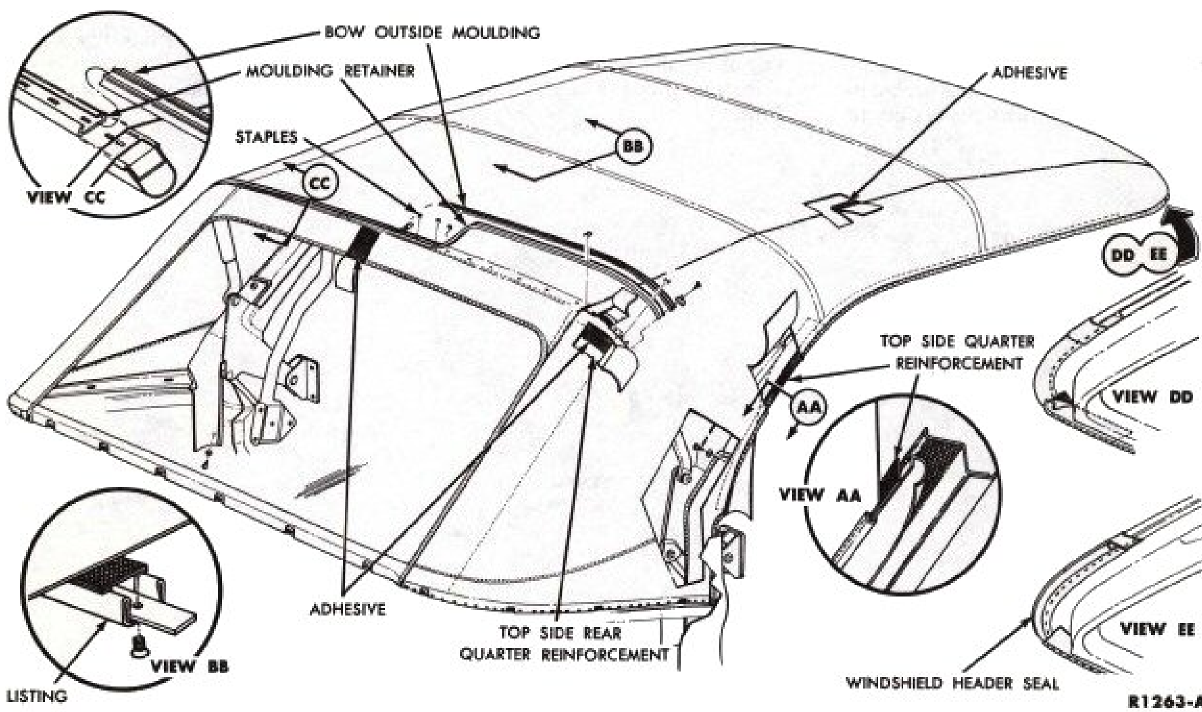

FIG. 14—Convertible Top Trim Installation

7. Remove the metal screw and washer that secures each end of the folding top compartment well to the pivot bracket supports (Fig. 14).

8. Disengage the well trim retainer from the tacking strips.

9. Remove the top (Fig. 14) from each end of the moulding on the rear bow. Carefully pull the moulding out of the retainer. Pry the moulding retainer off the bow.

10. Remove the bolts that attach the top and back curtain tacking strips to the body.

11. Remove the staples that secure the top material to the rear bow.

12. Carefully pull the top material free from the underside of each side rail.

13. Remove the staples that secure the top material to the underside of the front bow.

14. Remove the retainer screws and carefully separate the top from the listings on No. 2 and 3 bows. Remove the staples that secure the top back stay-pads.

15. Remove the staples that secure the upper end of the back curtain to the rear bow. Remove the curtain.

INSTALLATION

1. Remove the tacking strips from the old top and back curtain.

2. Staple them to the new top and back curtain in the same location as they were on the old top.

3. Center the dot on the back curtain with the V mark (center) on the rear bow and staple the upper half of the zipper to the bow. Separate the curtain from the upper half of the zipper.

4. Retack the top back stay pads. Fit the new top on the roof bows.

5. Working from the center outward, staple the top deck to the rear bow. Make sure that the rear section of the slits is stapled to the bow before drawing and stapling the front portion of the slits (Fig. 14).

6. Secure, and tighten the quarter deck tacking strips to the body as required to align the listings with the No. 2 and 3 bows.

7. Center the top material and pull it forward over the front bow to remove the wrinkles from the top deck and quarters. While the material is pulled over the front bow, make a reference mark on the material at the leading edge of the bow with a piece of chalk. The mark should extend the entire length of the bow.

8. Raise the top high enough to gain access to the underside of the front bow.

9. Align the reference mark to the leading edge of the bow and staple the material in place. Install the windshield header seal.

10. Install the weatherstrip and the retainers on the No. 1 bow.

11. Secure the flaps to the underside of the side rail with trim cement. Trim the excess material from the flaps.

12. Install the rear, center and the front weatherstrips on the side rails so that the end of the weatherstrips are in alignment with the side rail joints.

13. Secure and tighten the quarter deck tacking strips as required to align the listings with the No. 2 and 3 bows.

14. Install a piece of tape across the rear bow to cover the staples.

15. Install the moulding retainer, moulding and the two tips on the rear bow.

16. Secure the back curtain to the upper part of the zipper.

17. Secure the back curtain tacking strip in place with the attaching bolts. Tighten the bolts as required working from the center outward to remove all wrinkles.

18. Starting at one end of the folding top compartment, install the trim retainer onto the tacking strip flange.

19. Secure each end of the trim to the pivot bracket supports with a metal screw and washer.

20. Install the rear seat back and cushion.

21. Install listing retainers in the No. 2 and 3 bow listings and install the screws.

22. Remove the protective covers from the deck and the hood.

23. Clean all chalk reference marks from the top material.

MAINTENANCE SCHEDULE

GROUP 19

THOUSANDS OF MILES OR NUMBER OF MONTHS, WHICHEVER OCCURS FIRST (Except Where Noted)	As Required	6	12	18	24	30	36
ENGINE							
Change oil and filter		X	X	X	X	X	X
Adjust carburetor—idle speed, idle mixture and fast (cold) idle speed (automatic choke only)	X						
Adjust power steering idle speed compensator	X						
Clean carburetor air cleaner and filter		X	X	X	X	X	
Replace carburetor air cleaner filter							X
Clean crankcase oil filler breather cap		X	X	X	X	X	X
Check engine accessory drive belts and adjust or replace as required		X		X		X	
Clean positive crankcase ventilation system			X		X		X
Clean positive crankcase ventilation system valve		X	X	X	X	X	X
Check ignition timing and adjust as required			X		X		X
Check and adjust or replace distributor points	X						
Check and adjust or replace spark plugs	X						
Replace fuel filter							X
Adjust accelerator pump lever	X						
Replace engine coolant							X*
Check engine coolant level	X						
TRANSMISSION							
Adjust Fordomatic transmission bands†	X						
Adjust C-4 automatic transmission bands — Rear	X						
Adjust C-4 automatic transmission bands — Front							X
Check transmission oil level		X	X	X	X	X	X
CHASSIS							
Lubricate automatic transmission kickdown linkage		X	X	X	X	X	X
Check clutch linkage adjustment		X	X	X	X	X	X
Inspect and cross-switch wheels and tires	X						
Check power steering reservoir fluid level		X	X	X	X	X	X
Check master cylinder fluid level		X	X	X	X	X	X
Check axle fluid level		X	X	X	X	X	X
Lubricate front suspension ball joints							X
Change power steering filter							X
Check and adjust steering gear pre-load as required	X	X					
Clean and pack front wheel bearings as required					X†		
Lubricate universal joints							X
Check brake lines and lining					X		
Check air conditioning system	ANNUALLY AT BEGINNING OF A/C SEASON						
Check front wheel alignment and linkage and adjust as required			X		X		X
Lubricate power steering ball stud							X
Check tire pressure	X						
Check battery fluid level	X						
BODY							
Lubricate hood latch	X						
Lubricate hood auxiliary catch	X						
Lubricate door lock cylinders	X						
Lubricate luggage compartment lock cylinder	X						
Lubricate tailgate lock cylinders	X						
Lubricate tailgate support and hinges	X						
Lubricate fuel filler door hinges	X						
Check convertible top operation	X						
Clean body drain holes	X						
Check convertible top fluid level	X						
Replace windshield wiper blades	X						
Lubricate door hinge and hinge check	X						
Lubricate hood hinge pivots	X						
Lubricate luggage compartment hinge pivots	X						

*Or every two years †At mileage interval only

MAINTENANCE OPERATIONS

GROUP 20

PART 20-1 MAINTENANCE OPERATIONS

1 ENGINE

CHANGE OIL AND FILTER

1. Raise the car.
2. Remove the oil pan drain plug and allow the engine oil to drain into a container.
3. Place a drip pan under the filter. Unscrew the filter from the adapter fitting.
4. Coat the gasket on the filter with oil. Place the filter in position on the adapter fitting. Hand tighten the filter until the gasket contacts the adapter face, then advance it ½ turn.
5. Replace the oil pan drain plug and tighten it securely.
6. Refill the crankcase with the proper amount and grade of oil.
7. Lower the car.
8. Operate the engine at fast idle, and check for oil leaks. If oil leaks are evident, perform the necessary repairs to correct the leakage.

ADJUST CARBURETOR—IDLE SPEED, IDLE MIXTURE AND FAST (COLD) IDLE SPEED (AUTOMATIC CHOKE)

SIX CYLINDER CARBURETOR

Idle Adjustments. A stop screw at the throttle lever flange of the carburetor (Fig. 1) controls the engine idle speed. Turn the screw outward (counterclockwise) to increase the engine idle speed and inward (clockwise) to decrease the engine idle speed. Make the idle adjustments in the sequence listed.

INITIAL CURB IDLE. The initial curb idle adjustment will automatically set the initial fast idle rpm required.

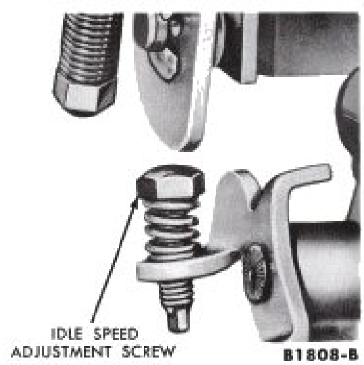

FIG. 1—Six Cylinder Idle Speed Adjustment

Position the choke control lever so that the choke plate is fully open. Seat the throttle plate in the throttle bore. **It may be necessary to back off on the dashpot adjustment screw to seat the throttle plate in the throttle bore.** Set the idle adjusting screw to just make contact with the cam contour; then, turn the screw outward (counterclockwise) an additional turn.

The "Final (Hot) Engine Idle and Fuel Mixture" adjustments provide the specified rpm required for the car model.

FINAL (HOT) ENGINE IDLE AND FUEL MIXTURE

1. Place the transmission selector lever in neutral position and set the parking brake.

2. Operate the engine at fast idle until the temperature has stabilized (approximately 1200 rpm for 30 minutes).

3. Attach a tachometer to the engine.

On a car with a manual-shift transmission, turn the idle speed "stop" screw in a direction to obtain the specified rpm. Open the throttle by hand and allow it to close normally. Recheck the engine idle speed.

On a car with an automatic transmission, **be sure the parking brake is on.** Place the transmission selector lever in neutral position. Check the engine idle speed and adjust it to the specified rpm in drive range.

Final engine idle speed may be varied to suit the conditions under which the car is to be operated.

4. Remove the tachometer if the idle fuel mixture is not going to be adjusted. If the idle fuel mixture is to be adjusted, leave the tachometer installed so that the idle speed can be checked after the mixture has been adjusted.

IDLE MIXTURE. The idle fuel mixture is controlled by the idle mix-

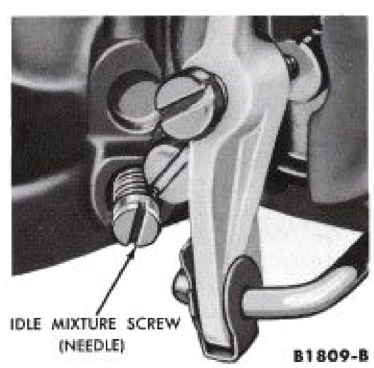

FIG. 2—Six Cylinder Idle Fuel Mixture Adjustment

ture adjusting needle (Fig. 2). Turn the needle inward to lean the mixture, and outward to enrich the mixture.

1. Adjust the engine idle speed.

2. Make the initial mixture adjustment by turning the screw inward until it lightly touches its shoulder; then, back it off the specified number of turns.

3. Be sure the engine is at normal operating temperature.

4. Turn the idle mixture screw (needle) inward until the engine rpm begins to drop, due to the lean mixture. Turn the needle screw outward until the engine rpm increases and begins to drop again, due to the rich mixture; then, turn the screw inward for maximum engine rpm and smoothness. **Always favor a rich mixture rather than a lean mixture.**

5. Check the engine idle speed and adjust it, if necessary.

V-8 CARBURETOR

Engine Idle Speed and Mixture (Hot)

1. Operate the engine for 30 minutes at 1200 rpm to stabilize engine temperatures. Be sure the dashpot is not interfering with the throttle lever, and make sure the choke fast idle cam is in the slow position (fast idle screw not contacting the fast idle cam).

On a car with an air conditioner, operate the air conditioner for 20 minutes before setting the engine idle speed.

2. Attach a tachometer to the engine. On a car with an automatic transmission, set the parking brake. Place the transmission selector lever in neutral range. Check the engine idle speed. Adjust the engine idle speed to specifications by turning the screw inward to increase the speed or by turning the screw outward to decrease the speed. **When performing this adjustment, be sure the dashpot is not interfering with the throttle lever or the fast idle adjusting screw is not contacting the fast idle cam.**

On a car with a manual-shift transmission, the engine idle speed is checked and adjusted with the transmission selector lever in neutral position. Adjust the engine idle speed to specifications by turning the screw inward to increase the speed or outward to decrease the speed. Be sure the fast idle screw is not touching the fast idle cam when performing this adjustment.

3. Turn each mixture screw (needle) in until the engine rpm begins to drop, due to the lean mixture. Turn the needles out until the engine rpm increases and then begins to drop, due to the rich mixture; then, turn the needles inward for maximum engine rpm and smoothness. The needles should be turned approximately the same amount. The final setting may vary about ½-turn difference between the needles. Always favor a slightly rich mixture rather than a lean mixture.

4. Check the final engine idle speed by manually opening and closing the throttle. Adjust the idle speed, if necessary.

Final engine idle speed may be varied to suit the conditions under which the car is to be operated.

Engine Fast (Cold) Idle Speed. The adjusting screw on the right side of the carburetor contacts one edge of the fast idle cam. The cam permits a faster engine idle speed for smoother running when the engine is cold during choke operation. As the choke plate is moved through its range of travel from the closed to the open position, the fast idle cam pick-up lever rotates the fast idle cam. Each position on the fast idle cam permits a slower idle rpm as engine temperature rises and choking is reduced.

Manually rotate the fast idle cam until the fast idle adjusting screw rests on the next to highest (starting) step of the fast idle cam, adjacent to the shoulder (kickdown step).

Start the engine and turn the fast idle adjusting screw as required to obtain the specified fast idle rpm.

Remove the tachometer if the idle fuel mixture is not going to be adjusted. If the idle fuel mixture is to be adjusted, leave the tachometer installed so that the idle speed can be checked after the idle fuel mixture has been adjusted.

ADJUST POWER STEERING IDLE SPEED COMPENSATOR

CHECK AND ADJUSTMENT

1. With the wheel in a straight-ahead position, set the engine to the proper idle speed.

2. If the engine idle speed is too high or low when the wheels are turned agianst the steering linkage stops, loosen the lock nuts on the power steering engine idle control valve mounting bracket. **Do not hold the wheels against the stops for periods over 15 seconds.**

3. Adjust the control valve until the proper engine idle speed can be maintained with the linkage against the stops.

4. Tighten the control valve lock nuts.

CLEAN CARBURETOR AIR CLEANER AND FILTER

REMOVAL

1. Remove the wing nut(s) retaining the air cleaner assembly to the carburetor and the air duct (if equipped with air duct).

2. Remove the air cleaner assembly from the carburetor. **To prevent dirt from entering the carburetor, the filter element must never be removed when the air cleaner body is mounted on the carburetor.**

3. Remove the cover and filter element. Discard the air cleaner mounting gasket on the carburetor if it is excessively worn or damaged.

FILTER ELEMENT

The filter element must never be cleaned with a solvent or cleaning solution. Also, oil must not be added to the surfaces of the filter element or air cleaner body.

There are two alternate procedures that can be used to clean the air filter element. One method is performed with the use of compressed air. The other is performed by tapping the element on a smooth horizontal surface.

Compressed Air Method. Direct a stream of compressed air through the element in the direction opposite that of the intake air flow, that is from the inside outward. **Extreme care must be exercised to prevent rupture of the element material.**

Tapping Method. Hold the element in a vertical position and tap it lightly against a smooth, horizontal surface to shake the dust and dirt out. **Do not deform the element or damage the gasket surfaces by tapping too hard.** Rotate the filter after each tap until the entire outer surface has been cleaned.

Inspection. Hold the filter in front of a back-up light and carefully inspect it for any splits or cracks. If the filter is split or cracked, replace it.

BODY AND COVER

Clean the air cleaner body and

cover with a solvent or compressed air. Wipe the air cleaner dry if a solvent is used. Inspect the air cleaner body and cover for distortion or damage at the gasket mating surfaces. Replace the cover or body if they are damaged beyond repair.

INSTALLATION

1. Install a new air cleaner mounting gasket on the carburetor, if necessary. Install the air cleaner body on the carburetor so that the word "FRONT" faces the front of the car.

2. Place the element in the air cleaner body. **Make sure the element gasket is properly seated.** Install the cover and connect the air duct to the air cleaner (if equipped with air duct). Tighten the retaining wing nut(s).

REPLACE CARBURETOR AIR CLEANER FILTER

REMOVAL

1. Remove the wing nuts retaining the air cleaner assembly to the carburetor and the air duct (if equipped with air duct).

2. Remove the air cleaner assembly from the carburetor. **To prevent dirt from entering the carburetor, the filter element must never be removed when the air cleaner body is mounted on the carburetor.**

3. Remove the cover and filter element. Discard the filter element. Discard the air cleaner mounting gasket on the carburetor if it is excessively worn or damaged.

INSTALLATION

1. Install a new air cleaner mounting gasket on the carburetor, if necessary. Install the air cleaner body on the carburetor so that the word "FRONT" faces the front of the car.

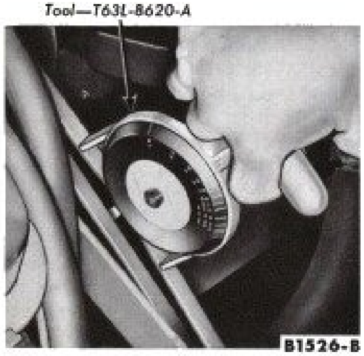

FIG. 3—Checking Drive Belt Tension

2. Place the new element in the air cleaner body. **Make sure the element gasket is properly seated.** Install the cover and connect the air duct to the air cleaner (if equipped with air duct). Tighten the retaining wing nuts.

CLEAN CRANKCASE OIL FILLER BREATHER CAP

Wash the crankcase filler cap in solvent. **Do not oil the filter mesh.**

CHECK ENGINE ACCESSORY DRIVE BELTS AND ADJUST OR REPLACE AS REQUIRED

BELT TENSION

1. Install the belt tension tool on the drive belt (Fig. 3) and check the tension following the instructions of the tool manufacturer.

2. If adjustment is necessary, loosen the generator or alternator mounting bolts and the generator or alternator adjusting arm bolt. Move the generator or alternator toward or away from the engine until the correct tension is obtained. Remove the gauge. Tighten the generator or alternator adjusting arm bolt and the mounting bolts. Install the tension gauge and check the belt tension.

If the car is equipped with air conditioning:

1. Loosen the four compressor mounting bolts.

2. Adjust the belt tension by sliding the compressor toward the center of the car to decrease the tension, and toward the outside of the car to increase the tension.

3. Tighten the four mounting bolts to specification and check the belt tension.

If the car is equipped with power steering:

1. Loosen the power steering pump bracket adjusting bolt and the pivot bolt.

2. Increase or decrease tension as required by adjusting the pump position.

3. Torque the adjusting bolt and the pivot bolt to specification, and check the power steering belt tension.

DRIVE BELT REPLACEMENT

1. On a car with power steering, loosen the power steering pump bracket at the water pump and remove the drive belt.

On a car with an air conditioner, remove the compressor drive belt.

2. Loosen the alternator or generator mounting bolts and the alternator or generator adjusting arm bolt. Move the alternator or generator toward the engine. Remove the belt(s) from the alternator or generator and crankshaft pulleys, and lift them over the fan.

3. Place the belt(s) over the fan. Insert the belt(s) in the water pump pulley, crankshaft pulley and alternator or generator pulley grooves. Adjust the belt tension to specifications.

4. On a car with an air conditioner, install and adjust the compressor drive belt to specifications.

5. On a car with power steering, install the power steering pump drive belt and tighten the pump bracket to the water pump. Adjust the drive belt tension to specifications.

CLEAN POSITIVE CRANKCASE VENTILATION SYSTEM

1. Remove the wing nut(s) retaining the air cleaner assembly to the carburetor. Remove the wing nuts that retain the air cleaner assembly to the air duct (if equipped).

2. Remove the air cleaner assembly from the carburetor.

3. Remove the regulator valve, intake manifold fitting, exhaust tube, connections, and outlet adapter.

4. Clean the valve, exhaust tube, intake manifold fitting, and outlet adapter in clean carburetor solvent and dry them with compressed air.

5. Clean the rubber hose connections with a low volatility petroleum base solvent and dry them with compressed air.

6. Install the regulator valve, intake manifold fitting, exhaust tube, connections and outlet adapter.

7. Install the air cleaner assembly on the carburetor.

8. Install the wing nut(s) retaining the air cleaner assembly to the

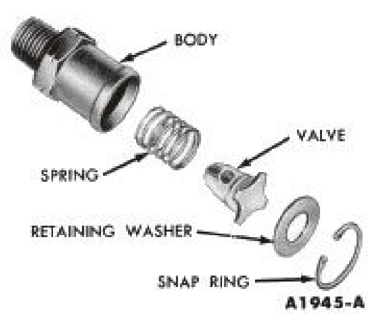

FIG. 4—Regulator Valve Assembly

carburetor. Install the wing nuts retaining the air cleaner assembly to the air duct (if equipped).

CLEAN POSITIVE CRANKCASE VENTILATION VALVE

REGULATOR VALVE DISASSEMBLY

Remove the retaining ring from the end of the regulator valve assembly using a snap ring retainer tool, then remove the valve retaining washer, valve and spring (Fig. 4).

CLEANING AND INSPECTION

1. Soak all regulator valve parts and metal fittings in carburetor solvent.

2. Probe all valve orifices and metal fitting passages with appropriate diameter drill or wire to insure removal of all emission deposits.

3. Thoroughly wash all parts in clean carburetor solvent and dry with compressed air.

REGULATOR VALVE ASSEMBLY

Assemble the regulator valve components in the following order:

1. Spring.

2. Valve with the pointed end toward the hose connection.

3. Valve retaining washer.

4. Valve retaining washer snap ring retainer.

CHECK AND ADJUST IGNITION TIMING AS REQUIRED

1. Disconnect the vacuum line. If necessary, clean and mark the desired timing mark.

2. Attach a timing light to the number one spark plug.

3. Connect a tachometer to the engine.

When connecting a tachometer to a car equipped with a transistorized ignition, connect the leads to the tachometer block (positive lead to red terminal, negative to black).

4. Start the engine and adjust the speed to the specified RPM for initial timing adjustment. Allow the engine to warm up.

5. Observe the timing with the light.

6. If the timing is not correct, loosen the hold down bolt and rotate the distributor clockwise to advance the timing or counterclockwise to retard it.

7. Tighten the hold down bolt and check the timing.

CHECK AND ADJUST OR REPLACE DISTRIBUTOR POINTS

Unsnap the distributor cap retaining clips, lift the distributor cap off the distributor housing, and position the cap out of the way (if necessary, remove the air cleaner and/or the high tension wire to gain access to the distributor).

Lift the rotor off the cam. Remove the dust cover (transistorized ignition).

INSPECTION

Replace the distributor point assembly if the contacts are badly burned or excessive metal transfer between the points is evident. Metal transfer is considered excessive when it equals or exceeds the gap setting.

REMOVAL

1. Remove the primary distributor-transistor lead and condenser wire (if equipped) from the breaker plate.

2. Remove the screw attaching the ground wire to the distributor point assembly.

3. Remove the screw nearest the distributor points, then remove the distributor point assembly.

INSTALLATION

1. When installing new distributor points, reverse the procedure for removal and make sure that the ground wire is attached to the distributor point assembly attaching screw which is furthest from the distributor points.

2. If the used points are serviceable, set the gap using a dwell meter.

To set the gap with a dwell meter:

Connect the dwell meter following the manufacturer's instructions.

NOTE: **In a car equipped with transistor ignition, make sure that the dwell meter is connected to the tachometer block rather than the coil.**

Operate the engine at idle speed and note the reading on the dwell meter.

Stop the engine and adjust the gap (decreasing the gap increases the dwell). Now check the dwell again.

Repeat this procedure until specified dwell is obtained.

If new points are installed, set the gap to specifications using a feeler gauge.

3. Install the dust cover (transistorized ignition).

4. Install the rotor. Install the distributor cap on the distributor housing and snap the retaining clips in place.

5. Install the air cleaner and/or the high tension lead if either was removed.

FIG. 5—Cleaning Plug Electrode

CHECK AND ADJUST OR REPLACE SPARK PLUGS

REMOVAL

1. Remove the wire from each spark plug by grasping the moulded cap of the wire only. **Do not pull on the wire because the wire connection inside the cap may become separated or the weather seal may be damaged.**

2. Clean the area around each spark plug port with compressed air, then remove the spark plugs.

3. Clean the plugs on a sand blast cleaner, following the manufacturer's instructions. **Do not prolong the use of the abrasive blast as it will erode the insulator.** Remove carbon and other deposits from the threads with a stiff wire brush. Any deposits will retard the heat flow from the plug to the cylinder head causing spark plug overheating and pre-ignition.

4. Clean the electrode surfaces with a small file (Fig. 5). Dress the electrodes to secure flat parallel surfaces on both the center and side electrode.

5. After cleaning, examine the plug carefully for cracked or broken

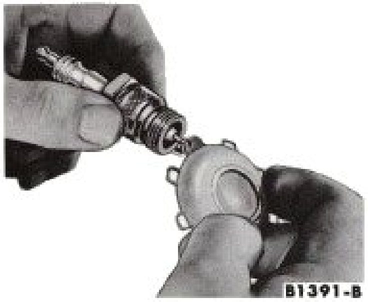

FIG. 6—Gapping Spark Plug

insulators, badly pitted electrodes, and other signs of failure. Replace as required.

ADJUSTMENT

Set the spark plug gap to specifications by bending the ground electrode (Fig. 6).

INSTALLATION

1. Install the spark plugs and torque each plug to 15-20 ft-lbs.

When a new spark plug is installed in a new replacement cylinder head, torque the plug to 20-30 ft-lbs.

2. Connect the spark plug wires. Push all weather seals into position.

REPLACE FUEL FILTER

1. Raise the car.
2. Remove the filter housing gasket and filter element. Discard the filter element.
3. Place a new filter element in the filter recess. Lightly lubricate and position the gasket, then screw the filter housing on. Hand tighten the filter housing until the gasket contacts the filter recess body, then advance it ⅛ turn.
4. Lower the car.
5. Start the engine and check for leaks.

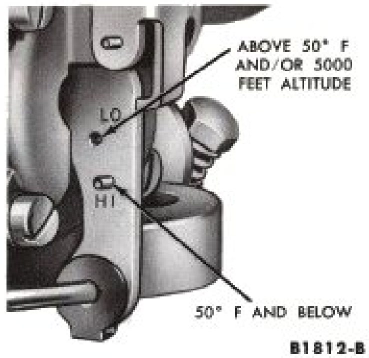

FIG. 7—Six Cylinder Carburetor Accelerating Pump Lever Adjustment

ADJUST ACCELERATING PUMP LEVER

SIX-CYLINDER ENGINES

The pump stroke is controlled by changing the location of the roll pin in the lever stop hole (Fig. 7).

For operation in ambient temperature 50°F. and below, place the roll pin in the hole of the pump operating lever marked "H" (lower hole). For best performance and economy at normal ambient temperatures and high altitude (above 50°F. and/or above 5,000 feet altitude), place the roll pin in the "LO" (upper hole) of the lever.

V-8 ENGINES

Insert the link in the inboard hole of the pump lever for all settings. Insert the link into the overtravel lever to suit climatic conditions.

#4 hole for 40°F. and below.
#3 hole for 40°F. to 80°F.
#2 hole for 80°F. and above.

REPLACE ENGINE COOLANT

To drain the radiator, open the drain cock located at the bottom of the radiator. The cylinder block of the V-8 engines has a drain plug located on both sides of the block (Fig. 8). The six cylinder engines have one drain plug located at the left rear of the cylinder block.

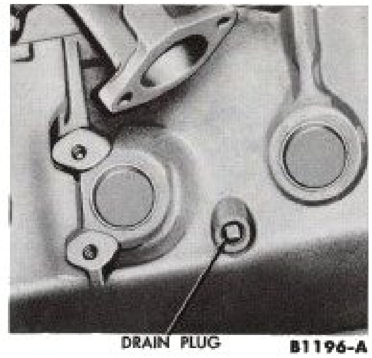

FIG. 8—Typical Cylinder Block Drain Plug

To fill the cooling system, close the drain cocks or install the plugs in the block and close the radiator drain cock. Fill the system to just below the filler neck of the radiator supply tank. Disconnect the heater outlet hose at the water pump to bleed or release trapped air in the system. When the coolant begins to escape, connect the heater outlet hose. Operate the engine until normal operating temperature has been reached. **After the initial fill, the coolant level will drop approximately one quart after the engine has been operated about 20 minutes at 2000 rpm. This is due to the displacement of entrapped air.** Add more coolant to fill the radiator supply tank.

CHECK ENGINE COOLANT LEVEL

The coolant level should be kept below the filler neck.

2 TRANSMISSION

ADJUST FORDOMATIC TRANSMISSION BANDS

LOW BAND ADJUSTMENT

The low band adjusting screw is threaded through the left front side of the case (Fig. 9).

1. Loosen the locknut several turns.
2. Tighten the adjusting screw with the tool shown in Fig. 9 until the tool is felt and heard to click. This tool is a pre-set torque wrench which clicks and overruns when torque on the screw reaches 10 ft-lbs.
3. Back off the adjusting screw exactly two turns.
4. Hold the adjusting screw at this position, and then torque the locknut to specification.

REAR BAND ADJUSTMENT

1. Drain the transmission. **If the same fluid is to be used again in the transmission after the band adjustment, filter the fluid through a 100-mesh screen as it drains from the transmission. Re-use the fluid only if it is in good condition.**
2. Remove the thoroughly clean the oil pan and screen. Discard the oil pan gasket.

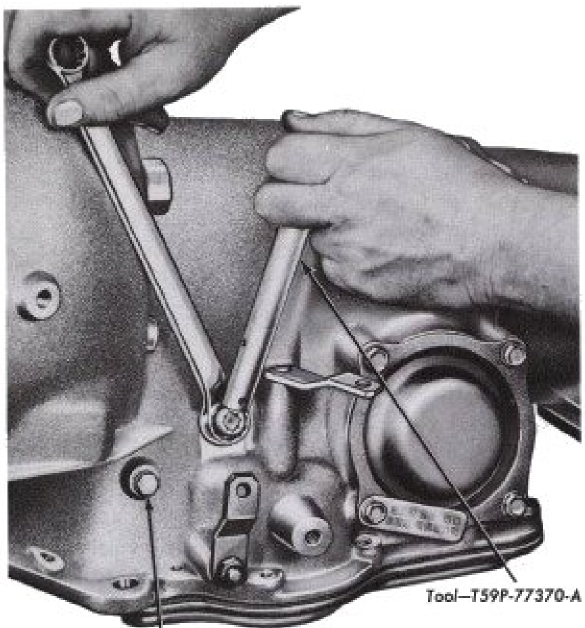

FIG. 9—Low Band Adjustment

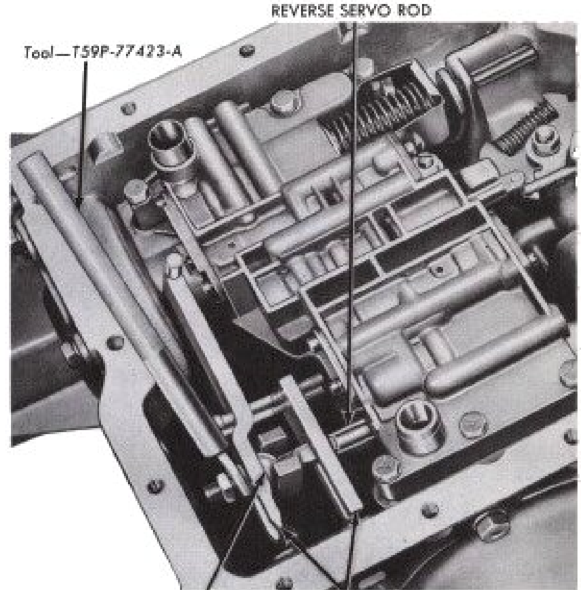

FIG. 10—Reverse Band Adjustment

3. Loosen the rear servo piston rod locknut and adjusting nut (Fig. 10).

4. Place the tool on the rear servo piston rod so that the two forks straddle the band apply lever. The inner fork must engage the flat on the servo piston rod. The outer fork is a ¼-inch spacer and must be inserted between the piston rod seat and the adjusting nut.

5. Back off the piston rod locknut so that the wrench shown in Fig. 10 can engage the adjusting nut. Tighten the adjusting nut until the wrench is felt and heard to click and overrun. This tool is a pre-set torque wrench which clicks and overruns when 45-50 inch-pounds torque is applied to the adjusting nut.

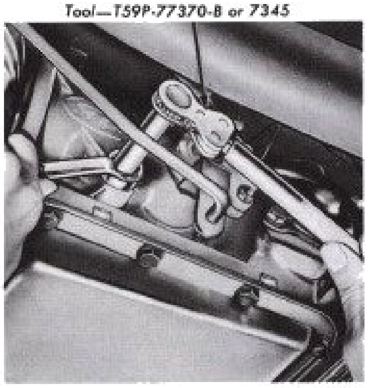

FIG. 11—Intermediate Band Adjustment

6. From the point that the wrench clicks, back off the adjusting nut exactly two turns.

7. Pull the tool (T59P-77409-A) away from the servo rod about one inch. This will permit the adjusting nut to drop into a nut holding slot provided in the tool.

8. Hold the adjusting nut against rotation and torque the locknut to specification.

9. Remove the tool from the servo piston rod.

10. Place a new gasket on the oil pan, and install the screen and pan on the transmission.

11. Fill the transmission.

ADJUST C4 AUTOMATIC DUAL RANGE TRANSMISSION BANDS

INTERMEDIATE BAND

1. Clean all the dirt from the band adjusting screw area. Loosen the lock nut several turns.

2. With the tool shown in Fig. 11 tighten the adjusting screw until the tool handle clicks. The tool is a pre-set torque wrench which clicks and overruns when the torque on the adjusting screw reaches 10 ft. lbs.

3. Back off the adjusting screw exactly 1½ turns.

4. Hold the adjusting screw from turning and torque the locknut to specification.

LOW-REVERSE BAND

1. Clean all the dirt from the adjusting screw area. Loosen the lock nut several turns.

2. With the tools shown in Fig. 12, tighten the adjusting screw until the tool handle clicks. The tool is a pre-set torque wrench which clicks and overruns when the torque on the adjusting screw reaches 10 ft-lbs.

3. Back off the adjusting screw exactly three full turns

4. Hold the adjusting screw from turning and torque the lock nut to specification.

FIG. 12—Low-Reverse Band Adjustment

CHECK AUTOMATIC TRANSMISSION FLUID LEVEL

1. Make sure that the car is standing level. Then firmly apply the parking brake.

2. Run the engine at normal idle speed. If the transmission fluid is cold, run the engine at fast idle speed (about 1200 rpm) until the fluid reaches its normal operating temperature. When the fluid is warm, slow the engine down to normal idle speed.

3. Shift the selector lever through all positions, and place the lever at P. Do not turn off the engine during the fluid level checks.

4. Clean all dirt from the transmission fluid dipstick cap before removing the dipstick from the filler tube.

5. Pull the dipstick out of the tube, wipe it clean, and push it all the way back into the tube.

6. Pull the dipstick out of the tube again, and check the fluid level. If necessary, add enough fluid to the transmission through the filler tube to raise the fluid level to the F (full) mark on the dipstick. **Do not overfill the transmission.**

CHECK TRANSMISSION OIL LEVEL—MANUAL SHIFT

1. Remove the filler plug from the side of the case.

2. If lubricant does not flow from the filler hole, fill the case with the specified lubricant until it is level with the lower end of the filler hole.

3. Install the filler plug.

3 CHASSIS

LUBRICATE AUTOMATIC TRANSMISSION KICKDOWN LINKAGE

Lubricate all pivot points in the kickdown linkage with SAE 10W engine oil.

CHECK CLUTCH LINKAGE ADJUSTMENT

1. Measure the total travel of the pedal (Fig. 13). If the travel is not within specification, move the clutch pedal bumper and the bracket up or down until the travel is within specified limits. **Always check and adjust total travel before checking free travel.**

2. With the clutch pedal against its bumper (pedal released), measure the overall length of the spring. The overall length should be 10¼ inches.

3. With the engine idling, depress the pedal just enough to take up the free travel and note the reading on the tape (Fig. 13). The difference between this reading and the reading where the pedal is released is the clutch pedal free travel. If the free travel is not within specification, adjust the clutch pedal to equalizer rod (Fig. 14). To increase the free travel loosen the rearward adjusting nut and tighten the forward nut. To reduce the free travel, loosen the forward nut and tighten the rearward nut. **Both nuts must be tightened**

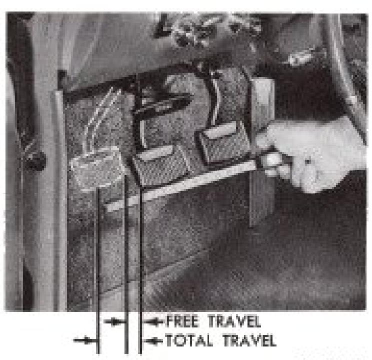

FIG. 13—Clutch Pedal Free Travel

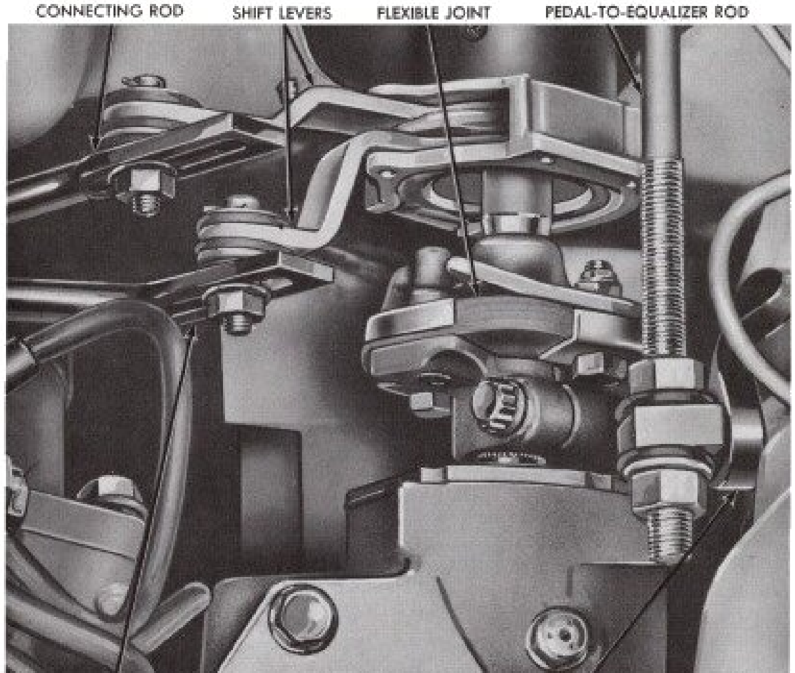

FIG. 14—Clutch Pedal Travel Adjustment—Typical

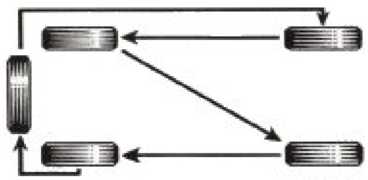

FIG. 15—Tire Cross Switching Diagram

against the trunnion after making the adjustment.

INSPECT AND CROSS-SWITCH WHEELS AND TIRES

Switch the tires according to Fig. 15.

Tighten the wheel nuts to specified torque.

CHECK POWER STEERING RESERVOIR FLUID LEVEL

Start the engine, turn the steering wheel all the way to the left and right several times, and shut off the engine.

Check the fluid level in the reservoir. If the level is low, add enough fluid to raise the level to the F mark on the dipstick. On a car equipped with air conditioning, fill the reservoir to within ¼-inch of the top. **Do not overfill the reservoir.**

CHECK MASTER CYLINDER FLUID LEVEL

1. Remove the filler cap from the master cylinder.
2. Fill the reservoir to ⅜-inch from the top.
3. Install the filler cap.

CHECK AXLE FLUID LEVEL

The lubricant level should be maintained at the bottom of the filler plug hole with the specified lubricant.

LUBRICATE FRONT SUSPENSION BALL JOINTS

Wipe any accumulated dirt from around the lubrication plugs.

Remove the plugs and install lubrication fittings. Lubricate the ball joints and remove the lubrication fittings. Install the plugs.

CHANGE POWER STEERING FILTER

Remove the power steering pump cover spring and washer. Remove all fluid from the reservoir with a suction gun. Lift the filter from the reservoir. Wipe the reservoir clean with a lint-free cloth. Place a new filter on the seat. Position the washer and spring on the cover stud. Install a new gasket in the cover. Install the cover on the reservoir.

CHECK AND ADJUST STEERING GEAR PRELOAD AS REQUIRED

1. Disconnect the Pitman arm from the steering arm-to-idler arm rod. On a car with power steering, disconnect the arm from the control valve ball stud.
2. Loosen the nut which locks the sector adjusting screw (Fig. 16), and turn the adjusting screw counterclockwise.
3. Measure the worm bearing preload by attaching an inch-pound torque wrench to the steering wheel nut (Fig. 17). With the steering wheel off center, read the pull required to rotate the input shaft approximately 1½ turns either side of center. If the torque or preload is not within specification, adjust as explained in the next step.
4. Loosen the steering shaft bearing adjuster lock nut, and tighten or back off the bearing adjuster (Fig. 16) to bring the preload within the specified limits.
5. Tighten the steering shaft bearing adjuster lock nut, and recheck the preload.
6. Turn the steering wheel slowly to either stop. **Turn gently against the stop to avoid possible damage to the ball return guides.** Then rotate the wheel 2¾ turns to center the ball nut.
7. Turn the sector adjusting screw clockwise until the specified pull is necessary to rotate the worm past its center (high spot). **No perceptible backlash is permissible at 30° on either side of center.**
8. While holding the sector adjusting screw, tighten the locknut to specifications and recheck the backlash adjustment.
9. Connect the Pitman arm to the steering arm-to-idler arm rod. On a car with power steering, connect the arm to the control valve ball stud.

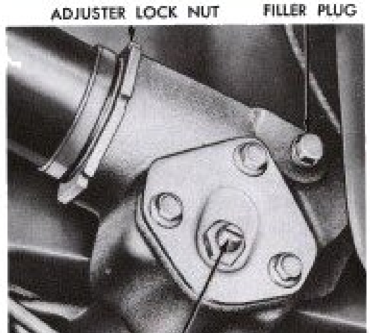

FIG. 16—Steering Gear Adjustments—Typical

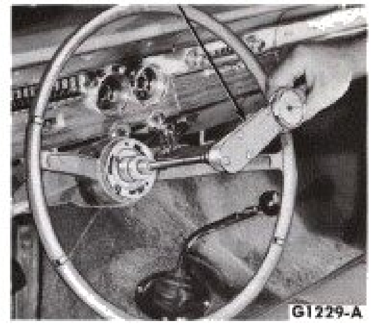

FIG. 17—Checking Preload

CLEAN AND PACK FRONT WHEEL BEARINGS

1. Raise the car until the wheel and tire clear the floor.
2. Insert a narrow screwdriver through the brake adjusting hole at the inner side of the brake carrier plate, and disengage the adjusting lever from the adjusting screw. While holding the adjusting lever away from the screw, back off the adjusting screw with the brake adjusting tool. **Be very careful not to burr, chip, or damage the notches in the adjusting screw; otherwise the self adjusting mechanism will not function properly.**
3. Remove the wheel cover or hub cap. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone and roller assembly.
4. Pull the wheel, hub, and drum assembly off the wheel spindle.
5. Remove the grease retainer and the inner bearing cone and roller assembly from the hub.

FIG. 18—Front Wheel Bearing Adjustment

6. Clean the lubricant off the inner and outer bearing cups with solvent.

7. Soak a new grease retainer in light engine oil at least 30 minutes before installation. Thoroughly clean the inner and outer bearing cones and rollers with solvent, and dry them thoroughly. Do not spin the bearings dry with compressed air.

Inspect the bearing cups, cones and rollers for wear or damage, and replace them if necessary. The cone and roller assemblies and the bearing cups should be replaced as a unit if damage to either is encountered.

8. Thoroughly clean the spindle and the inside of the hub with solvent to remove all old lubricant.

Cover the spindle with a clean cloth, and brush all loose dust and dirt from the brake assembly. **To prevent getting dirt on the spindle, carefully remove the cloth from the spindle.**

9. Pack the inside of the hub with specified wheel bearing grease. Add lubricant to the hub only until the grease is flush with the inside diameter of both bearing cups.

10. Pack the bearing cone and roller assemblies with wheel bearing grease. A bearing packer is desirable for this operation. If a packer is not available, work as much lubricant as possible between the rollers and cages. Lubricate the cone surfaces with grease.

11. Place the inner bearing cone and roller assembly in the inner cup, and install the new grease retainer. **Be sure that the retainer is properly seated.**

12. Install the wheel, hub, and drum assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

13. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut.

14. While rotating the wheel, hub, and drum assembly, torque the adjusting nut to 15-20 ft-lbs to seat the bearings (Fig. 18).

15. Locate the nut lock on the adjusting nut so that the castellations on the lock are aligned with the cotter pin hole in the spindle.

16. Back off both the adjusting nut and the nut lock together until the next castellation on the nut lock aligns with the cotter pin hole in the spindle.

17. Install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.

18. Adjust the brake shoes. Install the wheel cover.

LUBRICATE UNIVERSAL JOINTS

Wipe any accumulated dirt from around the lubrication plugs.

Remove the plugs and install lubrication fittings.

Apply the specified lubricant. Remove the fittings and install the plugs.

CHECK BRAKE LINES AND LINING

1. Raise all four wheels. Remove one of the front brake drums, and inspect the drum and the linings (the wheel bearings should be inspected at this time and repacked if necessary). **Do not let oil or grease touch the drum or the linings.** If the linings are worn to within 1/32 inch of the rivet heads, replace or reline both sets (primary and secondary) on the front or rear wheels. **Under no circumstances replace one lining only, or one wheel set. Both front wheel sets or both rear wheel sets should be replaced whenever a respective lining or shoe is worn or damaged.** If the drum braking surface is excessively scored, refinish it. The condition of the remaining front linings is usually about the same as that of the one inspected. The rear brake linings may also need replacing at the same time.

2. With the parking brakes in the fully released position, check the brake cables. The cable adjustment should be just tight enough to remove the slack. **Excessive tightening may pull the brake shoes off their anchors.**

3. Check all brake lines for leakage or physical damage and replace or repair as required.

4. Lower the car.

CHECK AIR CONDITIONING SYSTEM

A quick test of the refrigerant supply can be made by observing the flow of refrigerant through the sight glass (Fig. 19).

To check the refrigerant supply, place a large fan in front of the radiator to aid in cooling the engine. Set the servo control for maximum cooling and the blower on high. Operate the engine at 1300 rpm and observe the sight glass while the compressor is operating. There should be no bubbles in the sight glass after the start of the compressor. Bubbles will appear when the compressor starts but should clear after a few moments.

CHECK FRONT WHEEL ALIGNMENT AND LINKAGE

If abnormal tire wear or ride and handling characteristics such as vehicle lead or wander are experienced with properly inflated tires, the front end alignment should be checked.

FIG. 19—Sight Glass

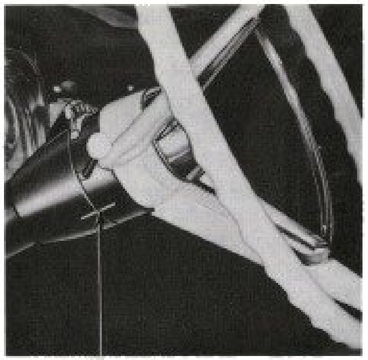

FIG. 20—Typical Straight Ahead Position Marks

FRONT WHEEL ALIGNMENT CHECKS

Do not check and adjust front wheel alignment without first making the following inspection for front end maladjustment, damage, or wear.

1. Check for specified air pressures in all four tires.

2. Raise the front of the car off the floor. Shake each front wheel grasping the upper and lower surfaces of the tire. Check the front suspension ball joints and mountings for looseness, wear, and damage. Check the brake backing plate mountings. Torque all loose nuts and bolts to specifications.

3. Check the steering gear mountings and all steering linkage connections for looseness. Torque all mountings to specifications. If any of the linkage is worn or bent, replace the parts.

4. Check the front wheel bearings. If any in-and-out free play is noticed, adjust the bearings to specification. Replace worn or damaged bearings.

FIG. 21—Upper Arm Assembly

5. Spin each front wheel with a wheel spinner, and check and balance each wheel as required.

6. Check the action of the shock absorbers. If the shock absorbers are not in good condition, the car may not settle in a normal, level position, and front wheel alignment may be affected.

Wheel Inspection. Wheel hub nuts should be inspected and tightened to specification at pre-delivery. Loose wheel hub nuts may cause shimmy and vibration. Elongated stud holes in the wheels may also result from loose hub nuts.

Keep the wheels and hubs clean. Stones wedged between the wheel and drum and lumps of mud or grease can unbalance a wheel and tire.

Check for damage that would affect the runout of the wheels. Wobble or shimmy caused by a damaged wheel will eventually damage the wheel bearings. Inspect the wheel rims for dents that could permit air to leak from the tires.

Check all the factors of front wheel alignment except toe-out on turns before making any adjustments. Toe-out on turns should be checked only after caster, camber, and toe-in have been adjusted to specifications.

Equipment Installation. Equipment used for front wheel alignment inspection must be accurate. If portable equipment is being used, perform all inspection operations on a level floor.

1. Drive the car in a straight line far enough to establish the straight-ahead position of the front wheels, and then mark the steering wheel hub and the steering column collar (Fig. 20). **Do not adjust the steering wheel spoke position at this time.** If the front wheels are turned at any time during the inspection, align the marks to bring the wheels back to the straight-ahead position.

2. Install the wheel alignment equipment on the car. Whichever type of equipment is used, follow the installation and inspection instructions provided by the equipment manufacturer.

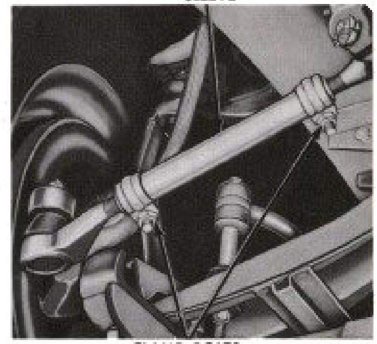

FIG. 22—Spindle Connecting Rod Sleeve

Caster. Check the caster angle at each front wheel.

The caster is the forward or rearward tilt of the top of the wheel spindle. If the spindle tilts to the rear, caster is positive. The spindle tilts to the front, caster is negative. The correct caster angle, or tilt, is $+\frac{1}{2}° \pm \frac{1}{2}°$. The maximum difference between both front wheel caster angles should not exceed $\frac{1}{2}°$.

Camber. Check the camber angle at each front wheel.

Camber is the amount the front wheels are tilted at the top. If a wheel tilts outward, camber is positive. If a wheel tilts inward, camber is negative. The correct camber angle, or outward (positive) tilt, is $+\frac{1}{2}° \pm \frac{1}{2}°$. The maximum difference between both front wheel camber angles should not exceed $\frac{1}{2}°$. However, a difference of not more than $\frac{1}{4}°$ is preferred.

Toe-In. Check the toe-in with the front wheels in the straight-ahead position. **Run the engine so that the power steering control valve will be in the center (neutral) position.** Measure the distance between the extreme front and also between the extreme rear of both front wheels. The difference between these two distances is the toe-in.

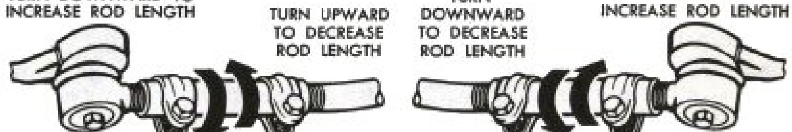

FIG. 23—Spindle Connecting Rod Adjustments

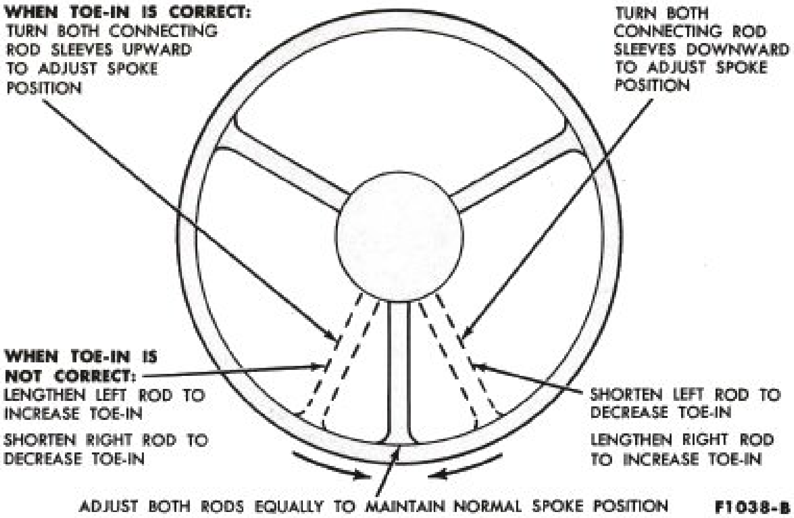

FIG. 24—Toe-in and Steering Wheel Spoke Alignment Adjustments

Correct toe-in, or inward pointing of both front wheels at the front, is 1/4-5/16 inch.

Front Wheel Turning Angle. After caster, camber, and toe-in have been adjusted to specifications, check the turning angle. See Part 3-6 for correct turning angle for cars equipped with standard or power steering. If this angle is not correct, a spindle arm is probably bent and should be replaced.

After front wheel alignment factors have been checked, make the necessary adjustments. **Do not attempt to adjust front wheel alignment by bending the suspension or steering parts.**

CASTER AND CAMBER ADJUSTMENTS

Caster and camber can be adjusted by removing or installing shims between the inner shaft of the front suspension upper arm and the underbody (Fig. 21).

Both caster and camber adjustments can be made at the same time by loosening the nuts on the two bolts that fasten the inner shaft to the underbody. After the required shims have been removed or installed, torque the nuts to specification. Caster and camber adjusting shims are available in 1/32-inch and 1/8-inch thicknesses.

The 1/32 inch shims should be placed against the fender housing sheet metal or between the 1/8 inch shims.

CASTER

To adjust caster, remove or install shims at either the front bolt or the rear bolt (Fig. 21).

The removal of shims at the front bolt or the installation of shims at the rear bolt will cause the upper ball joint to move forward. The removal of shims at the rear bolt or the installation of shims at the front bolt will cause the ball joint to move rearward. A 1/32-inch change of shim thickness at either bolt will change the caster angle approximately 1/2°. The difference between the shim stack thickness at the two bolts should not exceed 1/16 inch (Fig. 21).

CAMBER

To adjust camber, remove or install equal shim thicknesses at both bolts (Fig. 21).

The removal of equal shims at both bolts will move the upper ball joint inward. The installation of equal shims at both bolts will move the ball joint outward. A 1/16-inch change of shim thickness at both bolts will change the camber angle 1/3°. The total shim stack thickness at each bolt should not exceed 9/16-inch (Fig. 21).

TOE-IN AND STEERING WHEEL ALIGNMENT ADJUSTMENTS

Check the steering wheel spoke position when the front wheels are in the straight-ahead position. If the spokes are not in their normal position, they can be properly adjusted while toe-in is being adjusted.

1. Loosen the two clamp bolts on each spindle connecting rod sleeve (Fig. 22).

2. Adjust toe-in. If the steering wheel spokes are in their normal position, lengthen or shorten both rods equally to obtain correct toe-in (Fig. 23). If the steering wheel spokes are not in their normal position, make the necessary rod adjustments to obtain correct toe-in and steering wheel spoke alignment (Fig. 24).

3. Recheck toe-in and steering wheel spoke alignment. If toe-in is correct and the steering wheel spokes are still not in their normal position, turn both connecting rod sleeves upward or downward the same number of turns to move the steering wheel spokes (Fig. 24).

4. When toe-in and steering wheel spoke alignment are both correct torque the clamp bolts on both connecting rod sleeves to specification. **The sleeve position should not be changed when the clamp bolts are tightened.**

LUBRICATE POWER STEERING BALL STUD

Wipe the lubrication fitting clean and apply the specified lubricant.

CAUTION: **Care should be exercised to stop the addition of lubricant when the boot seal begins to inflate or bulge.**

CHECK TIRE PRESSURE

Check all tires for specified pressures (cold).

CHECK BATTERY FLUID LEVEL

The battery is mounted under the hood at the right front side of the engine compartment.

Keep the fluid in each battery cell up to the level of the ring in the bottom of the filler well. Generally, tap water may be added unless it has a high mineral content or has been stored in a metal container.

4 BODY

LUBRICATE HOOD LATCH

Apply Rotunda Silicone Lubricant R-113 (Ford Specification M99C40-A or B) to all pivot points and to the striker plate as required to eliminate any binding condition. Operate the latch mechanism several times to be sure that the lubricant has effectively worked in.

LUBRICATE HOOD AUXILIARY CATCH

Apply Rotunda Silicone Lubricant R-113 (Ford Specification M99C40-A) to all pivot points as required to eliminate any binding conditions. Operate the catch several times to be sure that the lubricant has effectively worked in.

LUBRICATE DOOR LOCK CYLINDERS

Apply Rotunda lock lubricant R-117-A (Ford Specification M2C20) sparingly through the key slot. Insert the key and operate the lock several times to be sure that the lubricant has effectively worked in.

LUBRICATE LUGGAGE COMPARTMENT LOCK CYLINDER

Apply Rotunda lock lubricant R-117-A (Ford Specification M2C20) sparingly through the key slot. Insert the key and operate the lock several times to be sure that the lubricant has effectively worked in.

LUBRICATE TAILGATE LOCK CYLINDER

Apply Rotunda lock lubricant R-117-A (Ford Specification M2C20) sparingly through the key slot. Insert the key and operate the lock several times to be sure that the lubricant has effectively worked in.

LUBRICATE TAILGATE SUPPORT AND HINGES

Apply Rotunda Silicone Lubricant R-113 (Ford Specification M-99C40-A or B) to all pivot and friction points to eliminate any binding conditions. Operate the tailgate several times to be sure that the lubricant has effectively worked in.

LUBRICATE FUEL FILLER DOOR HINGES

Apply Rotunda Silicone Lubricant R-113 (Ford Specification M-99C40-A or B) to the hinge pivot points as required to eliminate any binding condition. Open and close the door several times to be sure that the lubricant has effectively worked in.

CHECK CONVERTIBLE TOP OPERATION

If convertible top operation becomes sluggish or slow, check the hydraulic reservoir fluid level. Fluid level should be approximately ¼ inch from the filler opening. The proper fluid for all cars is automatic fluid "Type A, Suffix A."

CHECK CONVERTIBLE TOP FLUID LEVEL

1. Remove the rear seat and raise the top.

2. Place absorbent cloths below the filler plug.

3. Remove the filler plug, and check the fluid level. It should be level with the bottom edge of the hole.

4. If the level is low, check the system for leaks, adding hydraulic fluid as necessary (Automatic Transmission Fluid "Type A, Suffix A").

REPLACE WINDSHIELD WIPER BLADES

Wiper blade replacement intervals will vary with the amount of use, type of weather, chemical reaction from road tars or salts and the age of the blades. Be sure that the windshield glass surface is not contaminated with oil, tree sap or other foreign substance which cannot be easily rubbed off.

Generally, if the wiper pattern across the glass is still uneven and streaked after these tests, replace the blades.

LUBRICATE DOOR HINGE AND HINGE CHECK

Apply Rotunda Silicone Lubricant R-113 (Ford Specification M-99C40-A or B) to the hinge pivot points as required to eliminate any binding condition. Open and close the door several times to be sure that the lubricant has effectively worked in.

LUBRICATE HOOD HINGE PIVOTS

Apply Rotunda Silicone Lubricant R-113 (Ford Specification M-99C40-A or B) to the hinge pivot points as required. Open and close the hood several times to be sure that the hinge pivots do not bind.

LUBRICATE LUGGAGE COMPARTMENT HINGE PIVOTS

Apply Rotunda Silicone Lubricant R-113 (Ford Specification M-99C40-A or B) to the hinge pivot points as required. Open and close the luggage compartment several times to be sure that the hinge pivots do not bind.

LUBRICATION CHARTS AND SPECIFICATIONS

GROUP 21

LUBRICATION CHARTS AND SPECIFICATIONS

Item	Part Number	Part Name	Ford Specification	Alternate Lubricant
Body Hinges	R113	Rotunda Silicone Lubricant	M-99C40-A or -B	
Brake Master Cylinder	R103-A	Rotunda Heavy-Duty Brake Fluid	M-3833-D	Alternate fluid must meet SAE J70B specifications for 70R3 type extra heavy-duty brake fluid.
Distributor Cam		Distributor Cam Grease	M-1C-66-A	Use a good high temperature No. 2 grade sodium soap grease.
Distributor Wick and Bushing		Engine Oil—SAE 10W		
Front Suspension Ball Joints	C1AZ 19590-B	FoMoCo Ball Joint Grease	ESA-M-1C47-A	Substitute must meet Ford Specification.
Front Wheel Bearings	C2ZA-19585-A	FoMoCo Wheel Bearing Grease	ESA-M-1C60-A	Substitute must meet Ford Specification.
Hood Latch and Safety Catch	R113	Rotunda Silicone Lubricant	M-99C40-A or -B	Substitute must meet Ford Specification.
Lock Cylinders	R117-A	Rotunda Lock Lubricant	ESB-M-2C20-A	Substitute must meet Ford Specification.
Rear Axle	C2AZ-19590-A	FoMoCo Hypoid Gear Lubricant	M-2C28-B*	Substitute must meet Ford Specification.
Steering Gear Housing (Manual or Power)	C3AZ-19518-A	FoMoCo Special Steering Gear Grease	ESW-M-1C87-A	A good lithium base grease No. 1 grade may be used to "add to" factory fill.
Steering—Power (Pump Reservoir) Convertible Top Reservoir	R106-A	Rotunda Automatic Transmission Fluid	M2C33-C or -D	Automatic transmission fluid marked "TYPE A, SUFFIX A" may be used to "add to" factory fill.
Transmission (Automatic)	R106-A	Rotunda Automatic Transmission Fluid	M2C33-C or -D	Only one quart of Automatic transmission fluid marked "TYPE A, SUFFIX A" may be used to "add to" factory fill.
Transmission (Manual Shift)	R139-A	Rotunda Manual Transmission Lubricant	M-568-D	Reputable SAE 80 grade mild extreme pressure type lubricant can be used to "add to" factory fill.
Universal Joints	C1AZ-19586-B	FoMoCo Universal Joint Lubricant	M-1C57	Substitute lubricant must conform to Ford Specification.

*SAE 90 grade lubricants are recommended for all temperatures above —25° F. For temperatures below —25° F. the same type of lubricant but of SAE 80 grade should be used.

ENGINE CRANKCASE OILS

Use of SAE 10W-30 oil will provide the proper viscosity for all normal ranges of outside temperatures. For operation at sustained outside temperatures below −10° F. a 5W-20 oil should be used.

Oil Quality

Use only oils which have been tested and certified by the maker as satisfying automobile manufacturers specifications for Engine Operating Sequence Tests for Service M.S. The Ford Motor Company specification covering these tests is M2C27. These tests are defined by ASTM committee D2 for Section G-IV of technical committee B and are published in the SAE Handbook.

These tests cover oil characteristics as follows:

Sequence I—Low Temperature Wear Prevention—(Cold Starts)

Sequence II—High-Speed—High Temperature Wear Prevention

Sequence III—High Temperature Deposit Formation—(Varnish)

Sequence IV—Corrosion and Rust Prevention

Sequence V—Sludge Formation

If engine oils are used which do not meet these requirements, it will be necessary to change oil more frequently than every 6,000 miles.

If it is necessary to use an "MS" oil which is not certified by the marketer as having passed the Engine Operating Sequence Tests, the addition of Rotunda Oil Conditioner to the oil will satisfy the requirements.

Oil Filter

Use of the right oil filter is also essential to good engine life and operation. For 6,000-mile filter change intervals, filters must meet Ford Specification ES-COAE-6714-A.

The Genuine Rotunda Oil Filter meets this requirement.

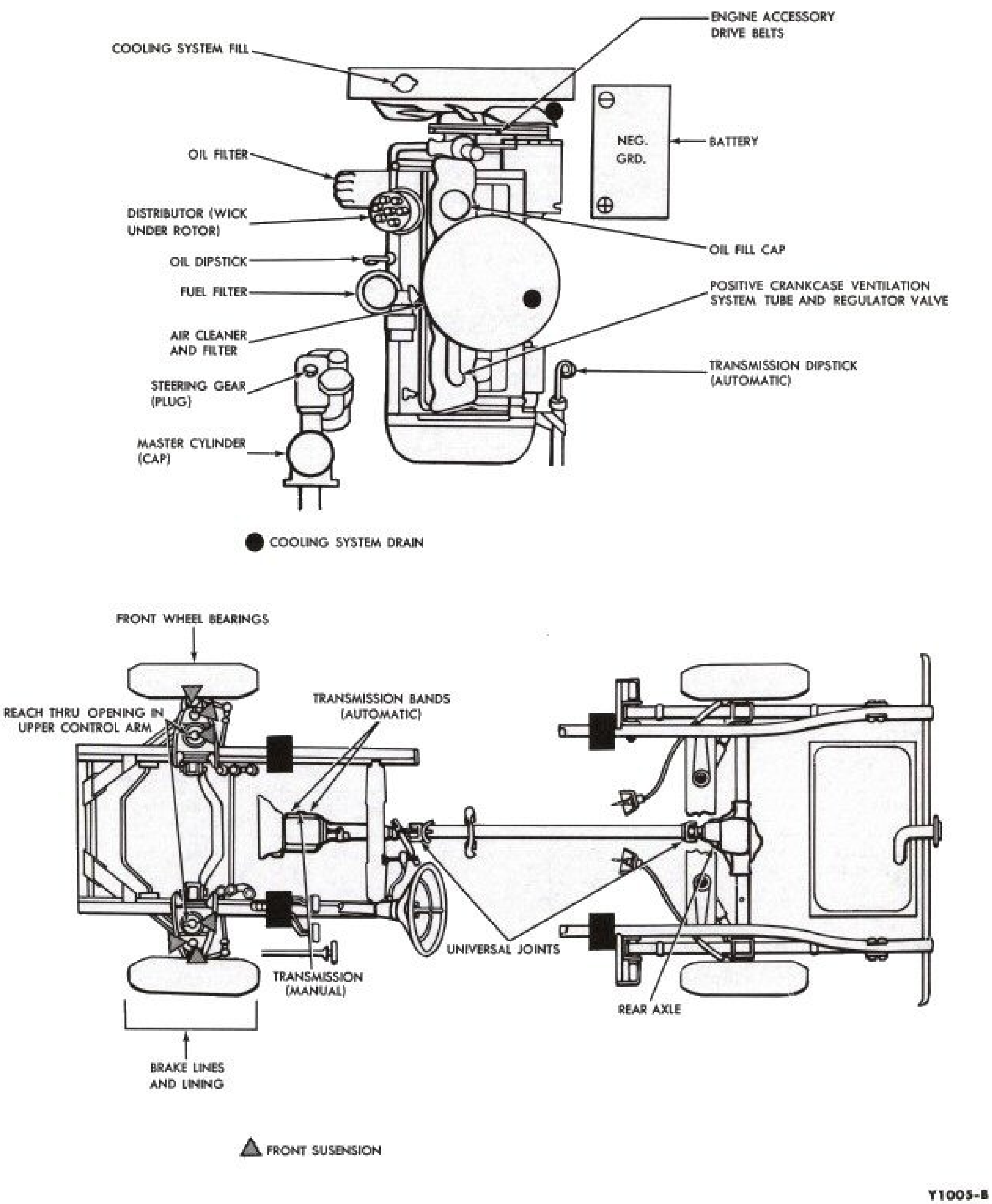

FIG. 1—Lubrication Chart—6-Cylinder Engine

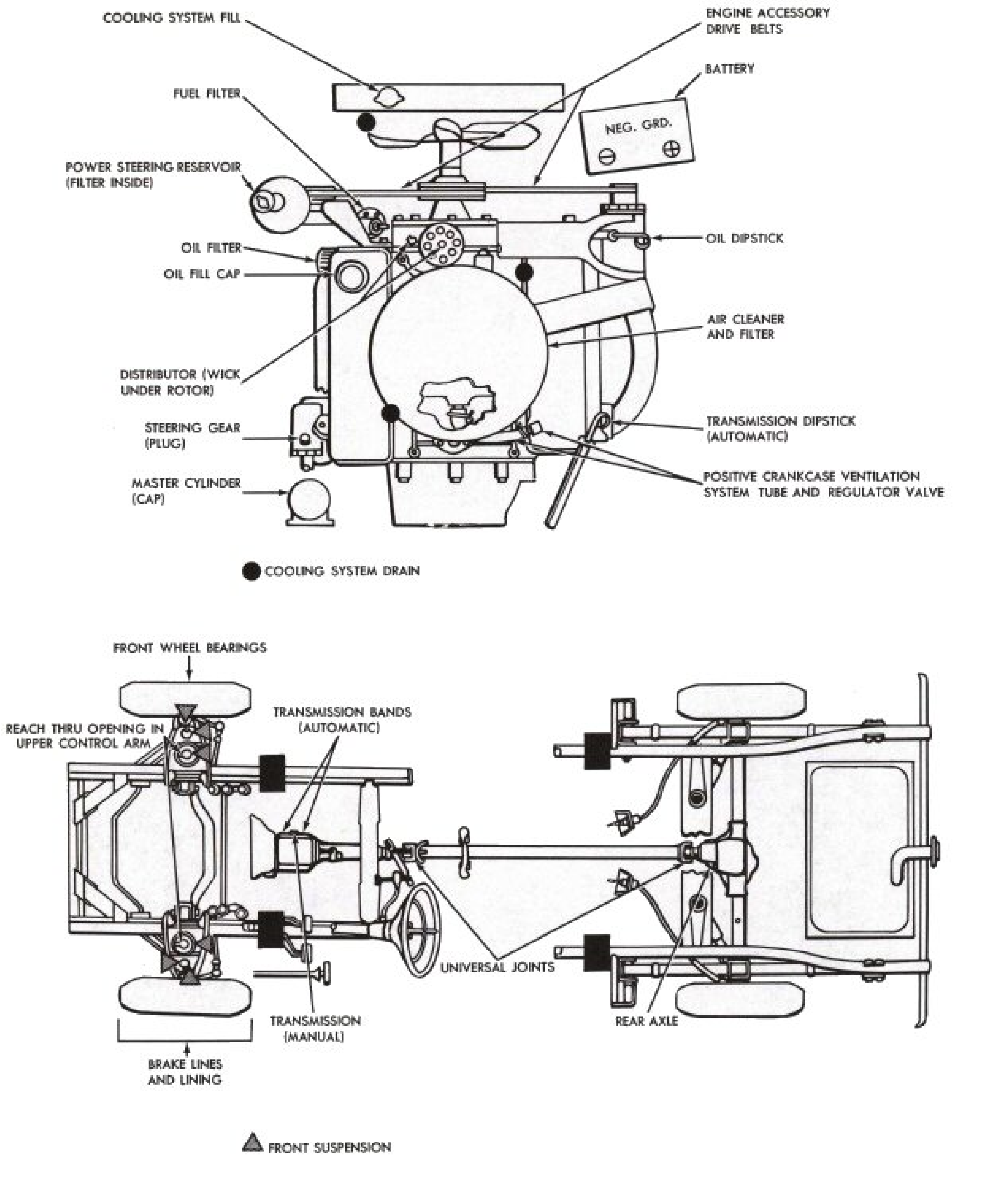

FIG. 2—Lubrication Chart— V-8 Engine

SPECIAL SERVICE TOOLS

GROUP 22

The usage of special service tools is illustrated and described in the text of this manual. Refer to the specific service procedure for the proper tool application.

The numbers shown in the first columns are Ford tool numbers. The second column indicates the former vendor tool numbers. These tools may be obtained from Ford by ordering by the **complete tool number** as shown in the first column.

BRAKES

Ford Tool No.	Former No.	Description
—	LM-119	Brake Cylinder Retaining Clamp
—	2035-N 2086-L	Brake Shoe Retracting Spring Remover and Installer
TOOL-4235-C	4235-C	Axle Shaft and Bearing Remover
—	1112-144	Inch-Pound Torque Wrench

SUSPENSION, STEERING, WHEELS AND TIRES

Ford Tool No.	Former No.	Description
T53L-200-A	—	Handle Adapter
—	OTC-462	Shock Link, Tie Rod Separator
T57P-3006-A	3006-B	Spindle Ball Joint Assembly Remover Press
T60K-3006-A	3006 C	Spindle Ball Joint Press Adapter Screw
TOOL-3290-B	3290 B	Dist. Gear and Tie Rod Ends Remover
TOOL-3290-C	3290 C	Tie Rod Ball Ends and Control Valve Ball Stud Remover
T61P-3355-A	3355 E	Idler Arm Bushing Remover and Replacer
T60K-3576-A	3576 AA	Sector Shaft Bushing Remover and Replacer
TOOL-3590-FCA	3590 FC	Pitman or Steering Arm Remover
TOOL-3660-AA	3600 AA	Bolt-on Type Steering Wheel Remover
T60K-5310-A	—	Front Coil Spring Compressor
T63L-8620-A	8620	Belt Tension Gauge
T56L-33610-D	3500-D	Power Steering Pump Pressure Gauge
T53P-33623-A	33623	Power Steering Pump Rotor Shaft Oil Seal Replacer Adapter

REAR AXLE

Ford Tool No.	Former No.	Description
T50T-100-A	B-160	Impact Hammer
T58L-101-A		Puller Attachment
T62L-201-A	—	Handle Adapter
T56L-400-A	4851-A	Puller
T57L-500-A	—	Bench Mounted Holding Fixture
TOOL-1175-AB	1175-AB	Grease Seal Remover (Head Only)
T50T-100-A and TOOL-1175-AB	1175-AE	Seal Remover
T60K-1177-B	1177-B	Rear Wheel Bearing Oil Seal Replacer
T62P-1177-A	—	Rear Wheel Bearing Oil Seal Replacer
T62F-1177-B	1177-C	Rear Wheel Bearing Oil Seal Replacer
T60K-1225-A	1225-C	Axle Shaft Bearing Replacer and Remover
—	1225-B	Axle Shaft Bearing Replacer (V-8)
TOOL-3552-H	3552-H	Special Jaws for 7600-E
T60K 4067-A	4067-E	Differential Bearing Adjuster Nut Wrench
TOOL-4209-C	4209-C	Pinion Tension Scale with TOOL-4209-C12 Socket

REAR AXLE (Cont'd)

Ford Tool No.	Former No.	Description
TOOL-4221-AL	4221-AL	Differential Bearing Cone Remover Pilot (Use with TOOL-4221-C or TOOL-4851-A)
T57L-4221-A	4222-K	Differential Bearing Cone Replacer
TOOL-4222-H	4222-H	Differential Bearing Cone Replacer
T60K-4234-A	4235-D	Rear Axle Shaft Assembly Remover Adapter
T57L-4614-A	4614	Drive Pinion and Drive Pinion Retainer Assembly Support
TOOL-4615-J	4615-J	Drive Pinion Front Bearing Cup Remover
T60K-4616-A	4615-HF 4625-HR	Pinion Bearing Cup Replacer
TOOL-4621-K	4621-K	Drive Pinion Bearing Cone Remover
T57L-4621-A	4625-F OTC-951	Drive Pinion Rear Bearing Cone Remover
T62F-4621-A	3355-C-2	Pinion Bearing Cone Replacer
T62F-4625-A	4625-AC	Drive Pinion Pilot Bearing Remover and Replacer
T55P-4676-A	4676-G	Drive Pinion Oil Seal Replacer
T62F-4676-A	4676-H	Drive Pinion Oil Seal Replacer
T53T-4851-A	4851-A 4858-D	Flange (Universal Joint) Axle End Remover
T57L-4851-A	4851-K	Universal Joint Flange Holder
TOOL-4858-E	4858-E	Companion Flange and Pinion Bearing Replacer
TOOL-6005-MD	6005-MD 6005-M	KRW Twin Stand Bracket Kit
TOOL-6005-MDM	6005-MDS 6005-MS	Manzel Twin Stand Bracket Kit
T58P-6019-A	6059-C	Cylinder Front Cover Pilot
TOOL-7025-G	7025-G	Main Shaft Bearing Remover and Replacer
T53T-44807-B	6306-AG-3	Coupling Shaft Support Bearing and Retaining Ring Replacer

CLUTCH AND DRIVELINE

Ford Tool No.	Former No.	Description
T61K-6392-A	—	Clutch Pilot and Flywheel Housing Runout Gauge Adapter
T64L-6392-A	—	Conversion Dial—Dial Indicator to D-1 (Dia-L-Igner Gauge)
T49P-7580-A	7580-A	Transmission Clutch Release Bearing Replacer

MANUAL SHIFT TRANSMISSION

Ford Tool No.	Former No.	Description
—	CJ-95	Drive Pinion Bearing Cone Remover-Typical
T50T-100-A	B-160	Impact Hammer
T59L-100-B	T59L-1000-A	Impact Slide Hammer
T58L-101-A		Puller Attachment
TOOL-1175-AB	1175-AB	Grease Seal Remover (Head Only)
T50T-100-A and TOOL-1175-AB	1175-AE	Seal Remover
TOOL-3552-H	3552-H	Special Jaws for 7600-E

MANUAL SHIFT TRANSMISSION (Cont'd)

Ford Tool No.	Former No.	Description
T57L-4220-A-4	—	Horseshoe Remover
T53T-4242-F-11	—	Pinion Bearing Cone Remover
TOOL-4621-K	4621-K	Drive Pinion Bearing Cone Remover
T53T-4621-B	4621-F	Pinion Bearing Cone Replacer (Front and Rear)
T57L-4621-B	4621-L	Pinion Bearing Cone Replacer
TOOL-6135-G	6135-G	Piston Pin Remover and Replacer
T52T-6500-DJD	6500-D	Solid Tappet Remover
T52L-7000-GAE	7000-G	Transmission Extension Housing Rear Bearing Remover
T57T-7003-A	—	Transmission Drive Bushing Replacer
TOOL-7025-B	7025-B	Rear Main Shaft Bearing Remover
TOOL-7025-G	7025-G	Main Shaft Bearing Remover and Replacer
T63P-7025-A	—	Output Shaft Bearing Remover and Replacer
T62K-7111-A	—	Cluster Gear Roller Retainer Shaft (¾" Bar Stock)
T57L-7111-A	7111	Cluster Gear Roller Retainer Shaft
T60K-7111-A	7111-F	Cluster Gear Roller Retainer Shaft
T63P-7111-B	—	Cluster Gear Roller Retainer Shaft (5.17)
T50T-7140-B	—	Reverse Idler Shaft Remover
T58L-101-A and T59L-100-B	7600-E	Seal Remover (Head and Hammer)
T55P-7657-A	7657-D	Transmission Extension Housing Oil Seal Replacer
T57L-7657-A	7657-F	Oil Seal Assembly Replacer
T60K-7657-B	7657-G	Transmission Extension Housing Oil Seal Assembly Replacer
T61L-7657-A	7657-AA	Transmission Extension Housing Oil Seal Replacer
—	7657-A	Transmission Extension Housing Bushing Replacer
TOOL-7688	7688 7688-N	Lockout Lever Oil Seal Replacer
T57P-7697-B	—	Transmission Extension Housing Bushing Replacer
T60K-7697-A	7000-AF	Transmission Extension Housing Bushing Remover
T60K-7697-B	—	Transmission Extension Housing Bushing Replacer
T57P-77047-A	70256-6B	Transmission Input Shaft Oil Seal Replacer
T60K-77047-A	33565	Transmission Input Shaft Oil Seal Replacer

AUTOMATIC TRANSMISSION

Ford Tool No.	Former No.	Description
T59L-100-B	—	Impact Slide Hammer
T58L-101-A		Puller Attachment
T53L-200-A	—	Handle Adapter
T57L-500-A	—	Bench Mounted Holding Fixture
TOOL-1175-AB	1175-AB	Grease Seal Remover (Head Only)
T50T-100-A and TOOL-1175-AB	1175-AE	Seal Remover
T53T-1175-E	—	Rear Wheel Grease Retainer Replacer
TOOL-3552-H	3552-H	Special Jaws for 7600-E
TOOL-4201-C	4201-C	Differential Backlash and Runout Gauge, with Universal Bracket, Dial Indicator and Bracket
TOOL-6005-MD	6000-MD 6005-M	KRW Twin Stand Bracket Kit
TOOL-6005-MDM	6005-MDS 6005-MS	Manzel Twin Stand Bracket Kit
TOOL-7000-DD	7000-DD	Air Nozzle Rubber Tip Assembly
T52L-7000-GAE	7000-G	Transmission Extension Housing Rear Bearing Remover
T52L-7000-HAE	7000-HF	Transmission Extension Housing Rear Bearing Remover
T59P-7000-A	7000-DG	Transmission Holding Fixture
T64P-7A128-A	—	Manual Valve Detent Spring
T64P-7B456-A	—	Clutch Race to Case Bolt Socket
T58L-101-A and T59L-100-B	7600-E	Seal Remover (Head and Hammer)
T61L-7657-A	7657-AA	Transmission Extension Housing Oil Seal Replacer

AUTOMATIC TRANSMISSION (Cont'd)

Ford Tool No.	Former No.	Description
T61L-7657-B	7657-AB	Transmission Extension Housing Oil Seal Replacer
T57P-7697-A	—	Transmission Extension Housing Bushing Remover
T57P-7697-B	—	Transmission Extension Housing Bushing Replacer
T60K-7697-A	7000-AF	Transmission Extension Housing Bushing Remover
T59P-7902-B	7937-B	Welded Converter Sprag Driver and Gauge Post
T63P-7902-A	—	Converter Stator Check Adapter
T64L-7902-A	—	Welded Converter Sprag Driver and Gauge Post Adapter Kit for T59P-7902-B
T59P-77059-A	77184 77185	Pinion Bearing Retainer Pins
T59P-77059-B	77059-B	Output Shaft and Carrier Assembly Holding Bracket
TOOL-77288	77288	Control Shaft Seal Replacer
T59P-77370-B	7345	Front Band Torque Wrench
T59P-77409-A	7355-A	Rear Band Gauge and Holding Tool
T59P-77423-A	7355-B	Rear Band Torque Wrench
T59L-77515-B	77515-A	Rear Clutch Spring Compressor
TOOL-77530-A	77530-A	Clutch Assembly Fixture
TOOL-77717	77717	Output Shaft Assembly Sleeve
T59P-77837-A	—	Front Pump Seal Replacer
T63L-77837-A	77837-A	Front Pump Seal Replacer

ENGINE

Ford Tool No.	Former No.	Description
T59L-100-B	—	Impact Slide Hammer
T58L-101-A	—	Puller Attachment
T59L-100-B and T58L-101-A	7600-E	Clutch Pilot Bushing Replacer
T53L-200-A	—	Handle Adapter
T53L-300-A	6000-BA	Engine Lifting Sling
—	KD-915	Valve Spring Compressor
T60K-6000-A	6000-AE	Engine and Transmission Assembly Lifting Hooks
TOOL-6001-FBA	6001-FBA	Engine Assembly Adapter to 6005-BK or BKS, 144-170 Engine
T52T-6005-CJD	6005-BKS	Engine Mount and Spindle (Splined Shaft)
T52T-6005-KJD	6005-BK	Engine Mount and Spindle (Keyed Shaft)
T61K-6019-A	4222-M 6059-E	Cylinder Front Cover Pilot
T61P-6019-B	6059-F	Cylinder Front Cover Pilot
T60K-6085-A	—	Cylinder Head Holding Fixture
T62F-6085-A	—	Engine Lifting and Head Holding Brackets
—	6149 A or E	Piston Ring Compressor
T60K-6135-A	6135-J	Piston Pin Remover and Replacer Press
T60K-6250-A	6261-AB	Camshaft Remover and Replacer Adapters
T62F-6250-A	6261-AD	Camshaft Bearing Adapters
T52L-6261-CEE	6261-C	Camshaft Bearing Remover and Replacer
T52L-6266-BGD	6266-B	Cylinder Head Core Plug, Cylinder Block Core Plug and Camshaft Bearing Bore Plug Replacer
T62F-6266-A	—	Camshaft Rear Bearing Bore Plug Adapter
TOOL-6306-AJ	6306-AJ	Crankshaft Damper Remover and Replacer
T52L-6306-AEE	—	Crankshaft Damper and Sprocket Replacer
T58P-6316-A	—	Crankshaft Damper Remover
TOOL-6331	6331	Upper Main Bearing Insert Remover and Replacer
T62F-6316-B	—	Crankshaft Damper Remover Adapter Screw
—	6392-N	Clutch Pilot
T52T-6500-DJD	6500-D	Solid Tappet Remover
—	6513-EE	Valve Spring Compressor
T62F-6565-A	6513-HH	Valve Spring Compressor

ENGINE (Cont'd)

Ford Tool No.	Former No.	Description
T58P-6700-B	6700-B 4676-H	Cylinder Block Front Cover Oil Seal Replacer Adapter
T60K-6700-A	6700-C	Crankshaft Front Cover Oil Seal Replacer
T60K-6701-A	6701-D	Crankshaft Rear Bearing Seal Replacer
T62F-6701-A	6701-E	Crankshaft Rear Seal Replacer
TOOL-7563-A	7563-A	Clutch Disc Alignment Pilot
T58P-7563-A	—	Disc Clutch Pilot
TOOL-7600-H	7600-H	Clutch Pilot Bearing Replacer
T52T-12175-AJD	—	Clutch Pilot Bearing Installer

IGNITION SYSTEM

Ford Tool No.	Former No.	Description
T57L-12120-A	—	Distributor Base Upper Bushing Replacer
T52L-12131-CAD	12131-C	Distributor Shaft Gear and Collar Retaining Pin Remover and Replacer Fixture
TOOL-12132	12132	Distributor Shaft Bushing Burnisher
TOOL-12132-A	12132-A	Distributor Shaft Bushing Replacer
—	12132-B1 or N	Distributor Shaft Bushing Remover
T58L-12132-B	T58P-12132-B	Distributor Body Holding Clamp
—	12150-D	Distributor Adjusting Wrench
TOOL-12151	12151	Distributor Point Tension Scale
T52L-12390-CAD	12390-C	Distributor Shaft Drive Gear Remover Kit
T52L-12390-DED	12390-D	Distributor Gear Locating and Installing Fixture
T57L-12390-A	12175-B	Tach Gear and Drive Gear Locating and Installing Fixture

FUEL SYSTEM

Ford Tool No.	Former No.	Description
T56L-9350-A	9350-F 9350-C	Fuel Pump Repair Overhaul Tool Kit
T57L-9904-A	—	Carburetor Power Valve and Gasket Test Fixture
T57L-9904-A17	—	Curved Wand Assembly

COOLING SYSTEM

Ford Tool No.	Former No.	Description
—	1225-C	Axle Shaft Bearing Remover (V-8)
—	1225-D	Axle Shaft Bearing Remover (6 cyl.)
—	4234-4	Axle Shaft Bearing Replacer
T57L-4614-A	4614	Drive Pinion and Drive Pinion Retainer Assembly Support
T57L-4621-A	4625-F OTC-951	Drive Pinion Rear Bearing Cone Remover
—	7675-N	Puller
TOOL-8501-F	8501-F	Water Pump Overhaul Kit
T52L-8501-DAD	8501-DD	Water Pump Overhaul Kit
T60K-8512-A	1225-D	Water Pump Impeller Replacer Adapter
T62F-8512-A	—	Water Pump Impeller Replacer Gauge
T62F-8530-A	—	Water Pump Bearing and Shaft Remover and Replacer
T63L-8620-A	8620	Belt Tension Gauge
TOOL-10094	10094 OTC-952	Bearing Remover Tool (Use with Arbor Press)

CHARGING SYSTEM

Ford Tool No.	Former No.	Description
T63L-8620-A	8620	Belt Tension Gauge
TOOL-10044-A	10044-A	Generator Pole Screw Wrench
TOOL-10505-F	10505-F	Voltage Regulator Adjustment Bending Tool
T56L-10505-A	M-183-RT6-5	Voltage Regulator Setting Thermometer

STARTING SYSTEM

Ford Tool No.	Former No.	Description
TOOL-10044-A	10044-A	Generator Pole Screw Wrench

AIR CONDITIONING

Ford Tool No.	Former No.	Description
ACM-57-2-TOOL	ACM-57-2	Leak Detector, Complete

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